LJ-82-06

SOUTHWEST FISHERIES CENTER

NATIONAL MARINE FISHERIES SERVICE
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EXPLORATORY ALBACORE LONGLINE FISHING IN THE EASTERN NORTH PACIFIC DURING WINTER 1982

by

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LONGLINING OPERATIONS ABOARD THE F/V TEMPTATION, JANUARY 1982. PHOTOGRAPH BY DIMITRY ABRAMENKOFF, NMFS.

ADDENDUM

Since the completion of this report an interesting fact was brought to light that is pertinent to the analysis of hook rates experienced by the individual vessels. The Pacific Pioneer had an overall average hook rate of 2.8. (See Summary of Hook Rates by Vessels, Table II, page 19). A review of their daily records shows that there is a sharp division between the initial 7 sets and the remaining 11 sets. The Pacific Pioneer, which departed from Hawaii, worked eastward during the first 7 sets to join the other vessels. For these sets the Pacific Pioneer had a hook rate of 0.8 albacore per 100 hooks. By the day of the 8th set, February 2, they had reached 141°30'W, the vicinity where the other vessels were operating. The average hook rate for the 8th and remaining sets was 3.6 albacore/100 hooks, a remarkable improvement. The January and February Japanese catch records averaged for 1975 through 1979 (Figures 8a and 8b) show that high catch rates might be expected in the more westerly longitudes that the Pacific Pioneer traversed, however individual months of individual years show a large variablility. Additionally, adverse weather hampered or curtailed fishing operations from this vessel during the first days of the survey. Another factor that is coincident with the change in catch rate is that there was a change in the gangion length on the 9th set. On the first 8 sets, 30 ft.& 36 ft. gangions were used; subsequently 9 ft. gangions were used.

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SUMMARY

Six chartered commercial fishing vessels conducted exploratory longlining operations for albacore tuna in an area centered about 1000 to 1500 miles west of San Diego during January-February 1982. A combined total of 112 sets was made on the survey. Each of the vessels typically set 800 to 1400 hooks in and about thermocline depths of 350 to 700 feet. A total of 70,939 pounds of albacore and 7,834 pounds of bigeye tuna was caught. Seven percent of the total albacore landings were fish taken on trolling gear. Individually the vessel landings ranged from 24,274 to 6,102 pounds of albacore and bigeye combined. Daily longline catches ranged from 0 to 136 albacore. The mean catch per set for all vessels was 31 albacore, equivalent to 3.2 fish per 100 hooks (3.4 if bigeye tuna are included). The average hook rate varied among vessels from 1.6 to 4.8 per 100 hooks. There was some fish loss due to line twisting, part of which occurred as the gear broke surface. This problem varied among vessels and can be largely reduced by modifications in gear and handling. The longline catches fell into two size groups, 14-18 pounds and 22-27 pounds.

Thirty-five days were allocated to each charter vessel; of these, 12 to 13 days were used in transit during which the vessels trolled for albacore. Of the 22-23 days on the longline fishing grounds, 3 to 4 were lost to rough weather, except for the one vessel which could operate. One vessel conducted acoustic tracking experiments for 4 days and another spent an additional 4 days trolling.

The results of this study show that the U.S. albacore fishery can be extended to operate during winter months using longline fishing operations in an area where the fleet has not traditionally fished. This potential for a mid-winter fishery exists as an important alternative to other winter fisheries or remaining idle. An additional factor of importance is that fuel consumption was 40% to 50% below that typical of trolling operations.

The large disparity between the catch rates of individual vessels suggests that we have much to learn about methods and gear to improve prospects for fishermen and to promote expansion of the fishery. Additional exploratory work is needed to examine the effect of seamounts and undersea ridges on fishing success. Also more knowledge is needed on the distribution of catches over the fall and winter seasons and their association with the seasonally changing oceanographic conditions. Experiments with artificial longline lures may also prove beneficial.

INTRODUCTION

The objective of this study is to evaluate the potential for establishing a U.S. fishery on North Pacific albacore during winter months in eastern North Pacific waters. An area several hundred miles off the coast of southern California and extending to the longitudes of about the Hawaiian Islands was selected for the study. The purposes of the study were: 1) to conduct exploratory fishing using longline fishing methods to determine if sufficient catches of albacore can be made to support an expansion of the U.S. fishery, 2) to make scientific observations to determine oceanographic conditions that may influence albacore distribution and catchability in the area, and 3) to collect scientific data for albacore biology and fishery studies. The scientific observations included: (a) acoustic tracking experiments to investigate the vertical distribution of albacore and the relationship of their distribution to vertical ocean temperature structure in the area, (b) vertical temperature profiles and surface ocean temperature measurements, (c) albacore tagging for migration and stock structure studies, (d) collection of detailed records on fish catch, amount of gear fished, modifications made to fishing gear and fishing tactics, and size composition of tuna caught, and (e) experiments to measure the depth distribution of longline gear during a set.

This study was conducted cooperatively between the National Marine Fisheries Service, Southwest Fisheries Center (SWFC) in La Jolla, California and the U.S. albacore fishing industry's American Fishermen's Research Foundation (AFRF). Saltonstall-Kennedy funds managed by the NMFS Southwest Regional Office in Terminal Island, California and awarded to the AFRF were used to charter fishing vessels and finance other costs. The operational aspects of the study were carried on by the AFRF and managed by the Western Fishboat Owner's Association (WFOA), a west coast association of albacore fishermen. Fishery scientists at the SWFC planned the study and worked with AFRF and WFOA to organize it. In addition, the SWFC provided scientific equipment. Fishery scientists were aboard three of the chartered fishing vessels to make scientific observations and to keep detailed records related to the fishing operations and catch.

BACKGROUND INFORMATION

The U.S albacore fishery has traditionally operated during summer and fall months, usually within a few hundred miles of the North American coast. In some years it extends as far south as central Baja California, Mexico and in some years as far north as northern British Columbia, Canada. In recent years U.S. fishermen have also begun to fish for albacore from near the dateline and eastward during early spring and summer months.

The AFRF was awarded two S-K grants for studies of exploratory longlining fishing operations. The first study, conducted cooperatively with the SWFC in January-February 1981, investigated the possibilities of expanding the U.S. albacore fishery to operate outside the traditional spring and summer seasons using longline fishing methods.[1] The results of the first study showed that

[1] A report of the results is found published in NOAA Technical Memorandum NMFS-SWFC-10, 1981, "Albacore trolling and longline exploration in eastern North Pacific waters during mid-winter 1981."

it was feasible for U.S. fishing vessels in the 50 to 80 foot size class to longline for albacore during the winter months. A limited quantity of gear was deployed with subsequent small catches in 1981; however, the catch rates were sufficiently high to suggest that a profitable winter albacore fishery could be developed.

This second study was designed to expand upon the 1981 findings. The amount of gear deployed was increased to reflect potential commercial efforts and a fishing strategy was proposed based upon associations of catch and subsurface thermal structure found in the first survey.

METHODS

FISHING VESSELS

Six commercial fishing vessels were selected by competitive bid for charter by the AFRF. The vessels received $25,000 in charter fees, up to $7,500 for fuel costs, and 2.5 tons of squid for longline bait. The fish catch, except for one ton per vessel which reverted to the AFRF, was retained for sale by the individual vessels.

The names of the fishing vessels, captains, home ports and lengths are shown in Table I along with the names of SWFC personnel who made scientific observations aboard three of the vessels.

Table I. Fishing Vessels Chartered for Study.

Vessel Name	Captain	Home Port	Vessel Length	SWFC Observer
Alaska	Palmer Pedersen	Seattle, WA	65 ft.	
Arrow	David Kelly	Sitka, AK	70 ft.	
Pacific Pioneer	Frank Barone	Honolulu, HI	75 ft.	
Sea World	James Gardner	San Diego, CA	67 ft.	Ron Dotson
Taasinge	Herman Haggren	Astoria, OR	73 ft.	Dave Holts
Temptation	Greg Gillette	Longview, WA	61 ft.	Dimitry Abramenkoff

AREA AND DATES OF STUDY

Field operations were conducted between January 13 and February 17, 1982. Longline fishing was centered in an area between about 30°30' to 32°N and 138° to 142°W, which is approximately 1,000 to 1,500 miles west of San Diego. A drawing of the cruise tracks and the area where most longline operations were centered is shown in Figure 1.

DESCRIPTION OF LONGLINE GEAR

Although longlining is an important fishing method used by foreign tuna fishermen, it has not been used by U.S. west coast fishermen to fish for tuna.

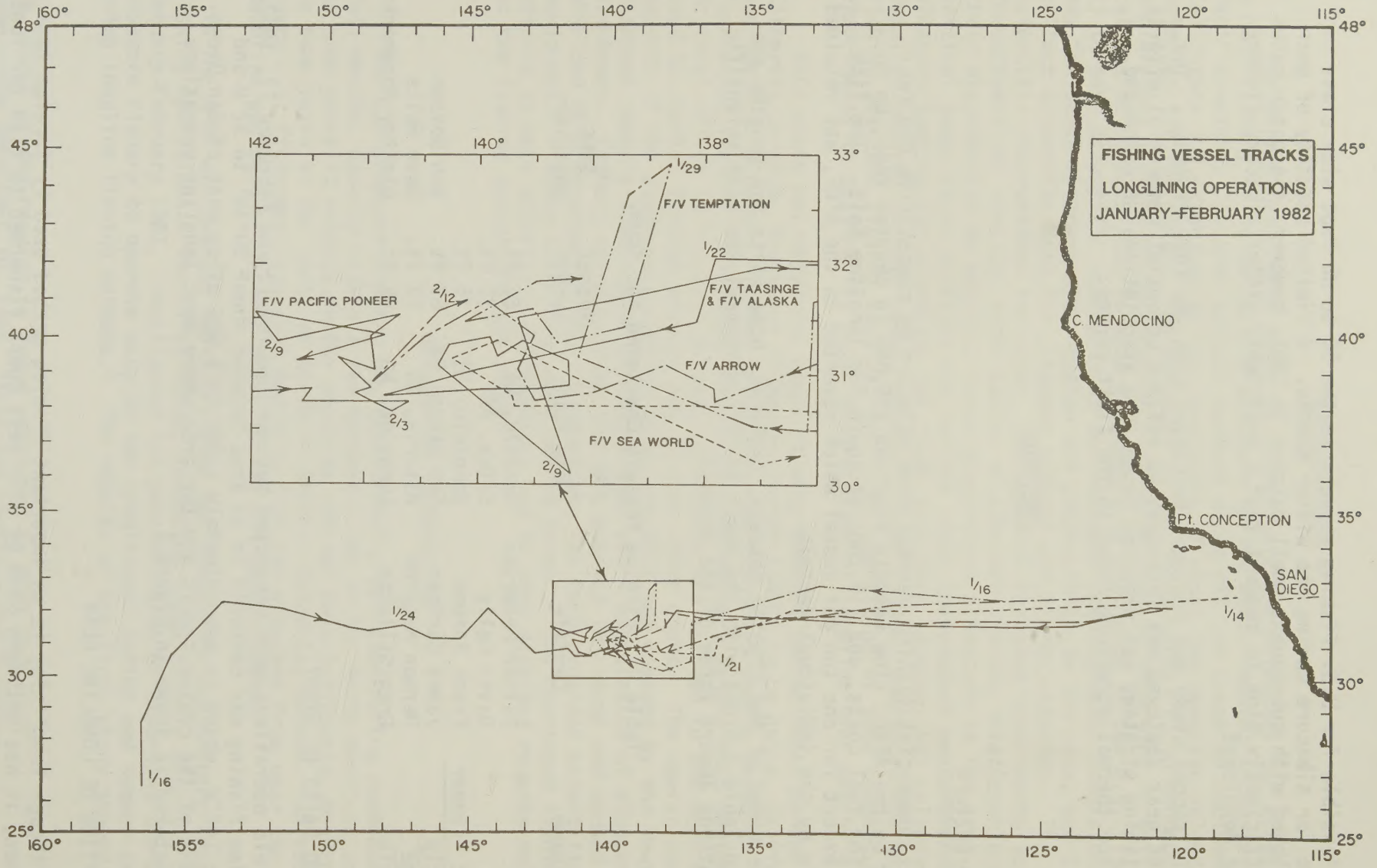


Figure 1. Fishing vessel tracks during January-February 1982 exploratory longline operations. The central exploratory fishing area is expanded to show movements of individual boats.

Longlining is used by U.S. fishermen, however, to catch northern halibut, black cod, and rockfish.

The longline gear used by the six chartered fishing vessels in this study consisted of a series of buoy lines suspended from the surface by floats, a main line attached to the buoy lines, and gangions with baited hooks suspended from the main line. Figure 2 gives a schematic sketch and identification of the components of the longline. The general design of the longline gear used by each of the vessels was similar; however, there were differences in materials and details of construction.

Buoy Line

The Alaska, Arrow, and Taasinge used buoy line constructed of 1/4-inch, three strand, right-hand lay nylon. This line, which is negatively buoyant, is used in the construction of halibut longline gear. The Temptation used 1/4-inch nylon and the Sea World used 3/8-inch braided cotton. The braided cotton was susceptible to chafing and several radar reflectors and flags were lost due to parting of the buoy line.

Usually 10 to 18-inch diameter inflatable floats were used for buoys and usually about every tenth buoy line was outfitted with a pole and flag. In some cases a radar reflector was used on the pole. The buoy line was attached to the main line with salmon snaps (see Figure 2). On all sets after the first three, the Temptation used 2-pound weights on the buoy lines. The Pacific Pioneer used 4-pound weights on one set (set No. 4) which caused the floats to submerge.

Buoy line lengths were often varied to set the main line at different depths. An XBT cast was made to determine the depth of the mixed layer and thermocline. Buoy lines of lengths usually ranging from 150 to 600 feet were then chosen to set the main line just above or within the upper portion of the thermocline or deep within the thermocline according to the intent of the captain. Figures 3a-3f show schematic diagrams of the longline gear deployment used by each of the vessels on a set by set basis. The buoy line lengths ranged between 350 and 600 feet for the Temptation, between 150 and 600 feet for the Alaska, between 450 and 600 feet for the Arrow, between 200 and 600 feet for the Pacific Pioneer, and between 300 and 600 feet for the Sea World and Taasinge.

Main Line

The main line used by the Alaska, Arrow and Taasinge was constructed of the same 1/4-inch line used for buoy lines. The Sea World used 1/4-inch, three strand nylon for a main line with knots tied every 10 fathoms to meter gangion placement and to prevent the gangions from sliding together. The Temptation used 7/32-inch braided nylon for main line. In a longlining configuration the length of line between floats (or weights) is termed a basket or skate. In halibut fishing a "standard" skate is 1800 feet which is the length of line commercially available in coils. Because some of the chartered vessels used differing lengths of line between floats we have chosen to use the term basket to avoid the frequent acceptance of a skate being 1800 feet long.

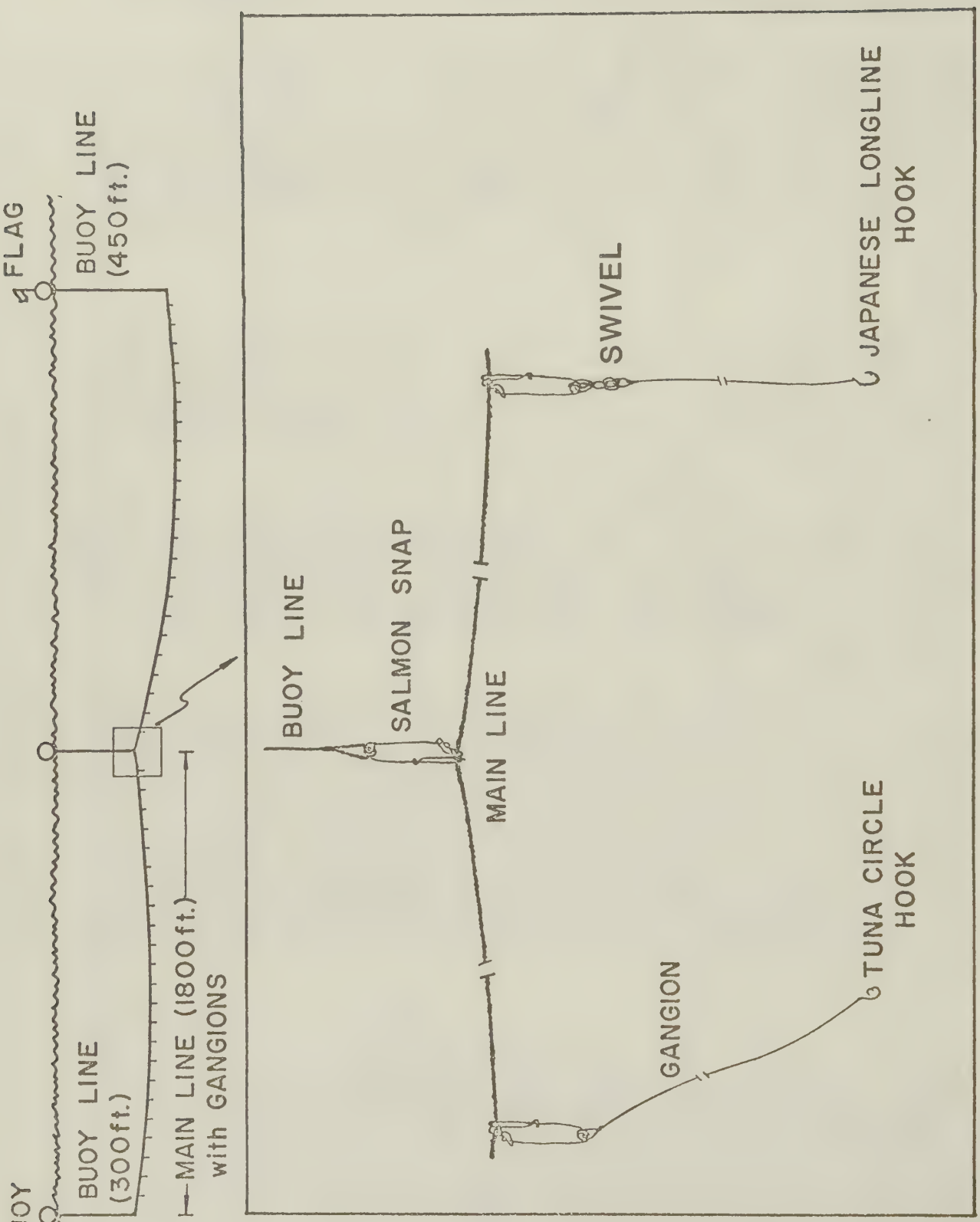
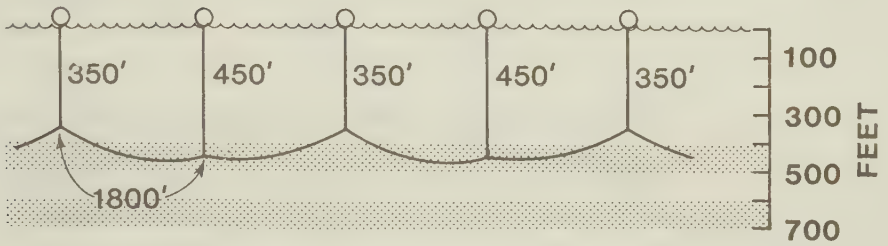


Figure 2. Components of longline gear used during 1982 survey.

Schematic Diagrams of Longline Gear Deployment

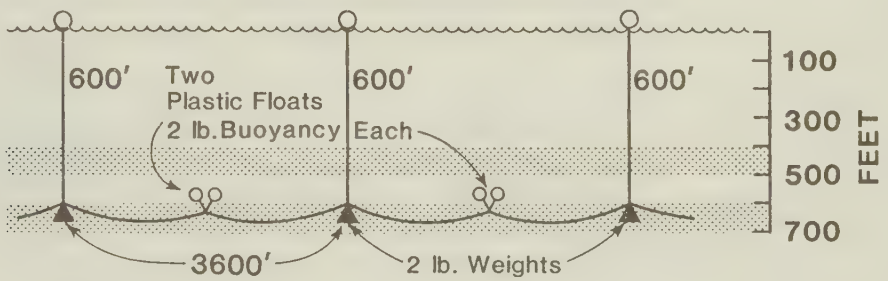
F/V TEMPTATION

SET NOS. 1 & 2:

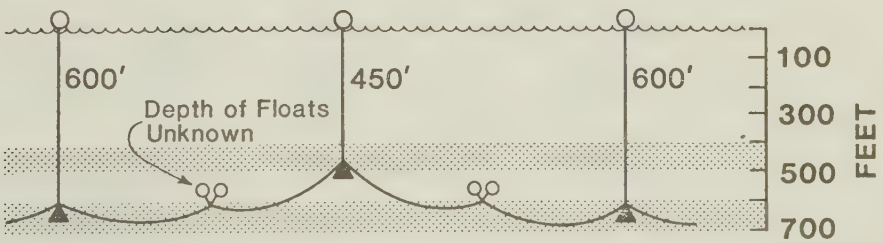


SET NO. 3: All 75' float lines

SET NOS. 4-9:



SET NOS. 10-15:

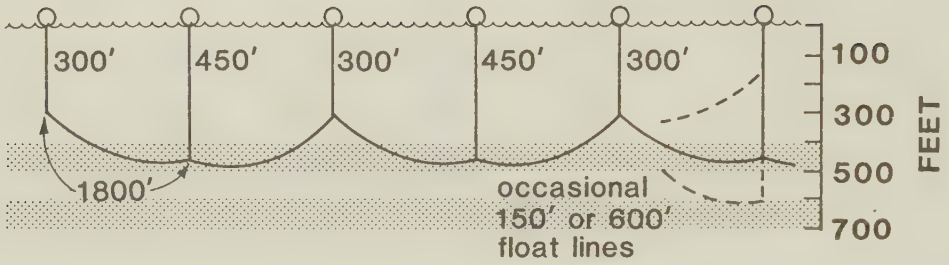


SET NO. 16: Same as set nos. 4-9 except all 450' float lines

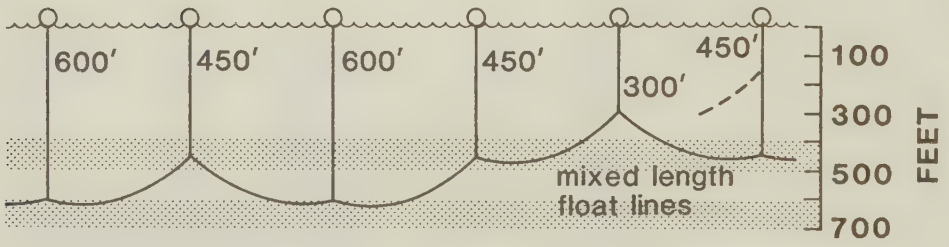
Figure 3a. Schematics of variations in longline gear configurations used by individual vessels during survey.

F/V ALASKA

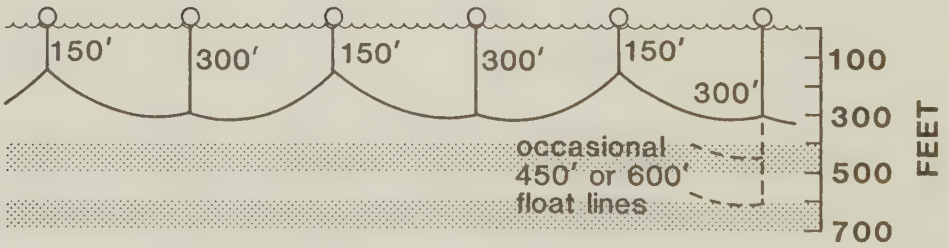
SET NOS. 1-4 & 15-20:



SET NOS. 5-9:



SET NOS. 10-13:

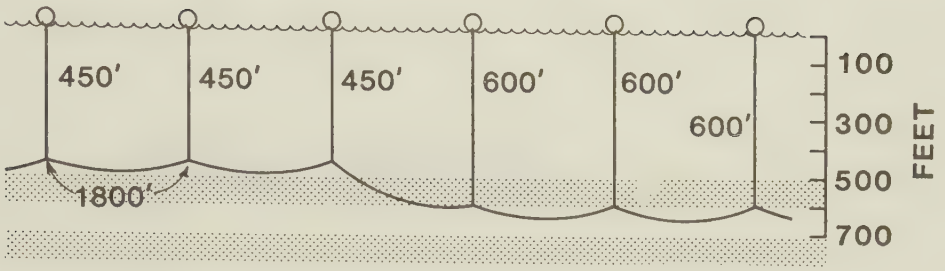


SET NO. 14: 1st half alternately 150' & 300' float lines
2nd half alternately 300' & 450' float lines

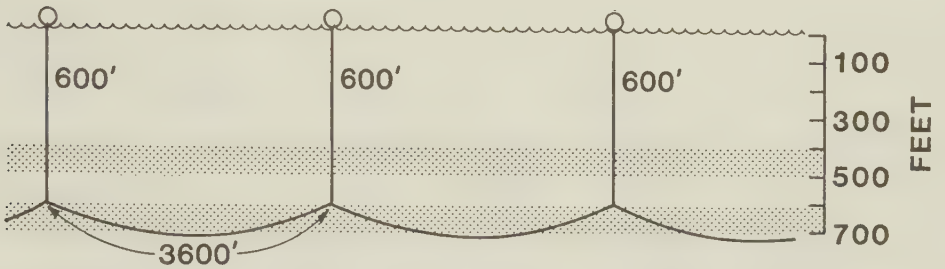
Figure 3b. Schematics of variations in longline gear configurations used by individual vessels during survey.

F/V ARROW

SET NOS. 1 & 2:

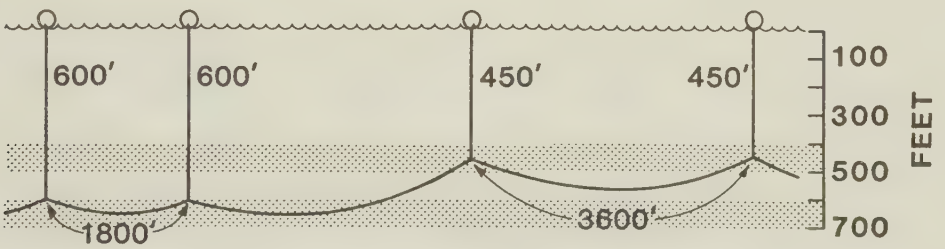


SET NO. 3:



SET NOS. 4 & 5: All 450' float lines & 3600' baskets

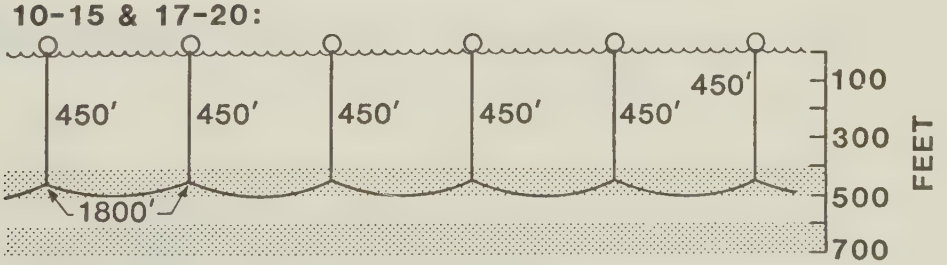
SET NOS. 6 & 7:



SET NO. 8: Mostly 450' float lines : Mixed 1800' & 3600' baskets

SET NO. 9: Mostly 450' float lines : Mostly 1800' baskets

SET NOS. 10-15 & 17-20:

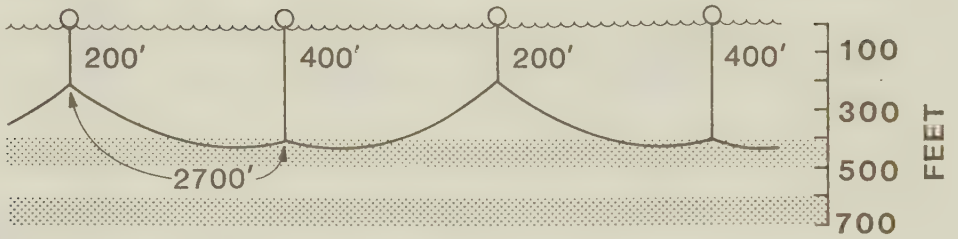


SET NO. 16: 300' Float lines : 1800' baskets

Figure 3c. Schematics of variations in longline gear configurations used by individual vessels during survey.

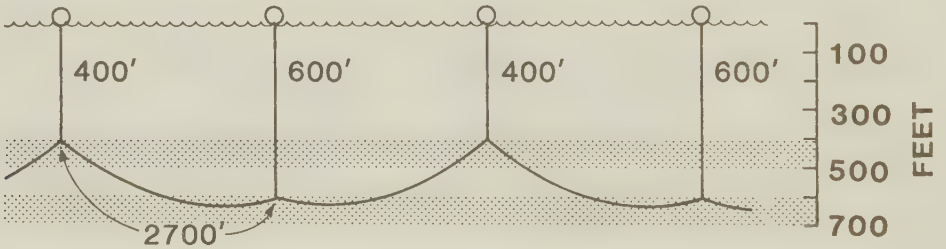
F/V PACIFIC PIONEER

SET NOS. 1,2&19:



SET NOS. 3&20: ALL 400' float lines

SET NOS. 5-16:



SET NO. 17: ALTERNATE GROUPS OF 300',400',600',400' float lines

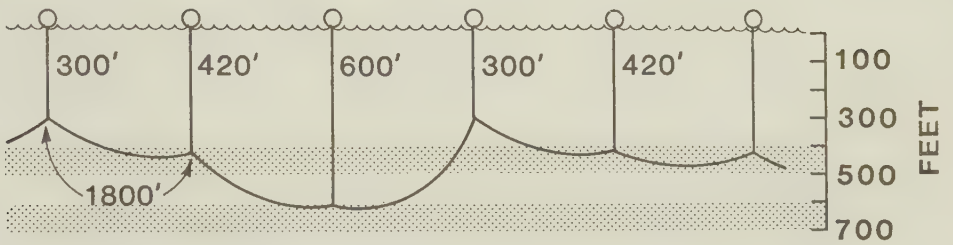
SET NO. 18: ALTERNATELY 300' & 600' float lines, beginning and ending with two 400' float lines

Figure 3d. Schematics of variations in longline gear configurations used by individual vessels during survey.

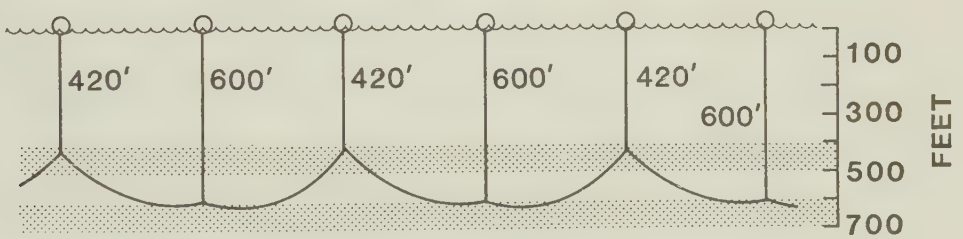
F/V SEA WORLD

SET NOS. 1,2&12: Alternately 300' & 420' float lines

SET NOS. 3-5:



SET NOS. 6-11:



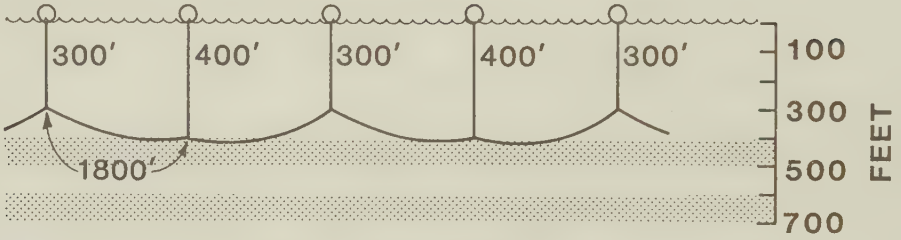
SET NO. 13: Night set: 30' float lines

Figure 3e. Schematics of variations in longline gear configurations used by individual vessels during survey.

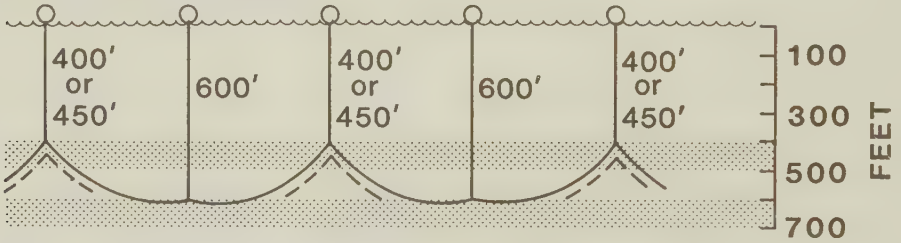
F/V TAASINGE

SET NOS. 1,2&4 : Alternately 300' & 450' float lines

SET NOS. 3,18,19,20,22,23:



SET NOS. 5,6,7,13,14,15,17:



SET NO. 8: 1st half 600' float lines: 2nd half alternately 600', 450' & 400' float lines

SET NOS. 9 & 10: 1st half 600' float lines: 2nd half 450' float lines

SET NO. 11: 1st half 450' float lines : 2nd half 600' float lines

SET NOS. 12 & 16: Alternately 400' & 450' float lines

Figure 3f. Schematics of variations in longline gear configurations used by individual vessels during survey.

The Pacific Pioneer used 2700-foot baskets. The Arrow used 3600-foot baskets in set nos. 3, 4 and 5 and mixed 1800-foot and 3600-foot baskets in set nos. 6 through 9. On all sets after the third set, the Temptation used a pair of small floats, having a combined buoyancy of 3 pounds, attached to the main line in place of a buoy every other 1800 feet. We believe these floats to have had minimal effect and have counted these as 3600-foot baskets. On all the remaining vessels and sets the baskets were 1800 feet.

The Arrow and Taasinge typically fished about 30 baskets per set, the Alaska and Sea World about 25, and the Pacific Pioneer about 20. The Temptation fished about 16 to 22 baskets when using 1800-foot gear and 13 baskets when using 3600-foot gear.

Gangions

The Alaska used 4 to 6-foot gangions made of 300 pound test monofilament with a barrel swivel at the snap and another located 10 to 12 inches above the hook. The Arrow used 6-foot gangions constructed of 300 pound test, translucent, blue or white monofilament connected by nicopress sleeves directly to the snap and the hook with no swivels. The gangions used by the Sea World were 6 feet long and constructed of 180 and 200 pound test, clear and green monofilament connected with nicopress sleeves to the hook and to a swivel on the snap. The snaps were spread slightly so they could slide or turn on the main line. Initially, the Taasinge used 6-foot gangions made of 220 pound test, blue monofilament and 300 pound test, translucent, white monofilament. As the cruise progressed the length was shortened to 5 feet and the 220 pound test monofilament was replaced by 300 pound test by mid-cruise. The monofilament was connected by nicopress sleeves directly to the snap and the hook with no swivels. The Pacific Pioneer used about 9-foot long gangions constructed of 225 pound test monofilament with no swivels in conjunction with no. 8 Mustad tuna circle hooks. However, the lengths and materials were varied on the gangions used with no. 36 Japanese tuna longline hooks. On the first two sets the gangions used with the no. 36 hooks consisted of 30 feet of 300 pound test braided nylon plus 6 feet of 225 pound test monofilament attached without swivels between the two types of lines or to the snap or hook. On sets 3 to 9 a leaded swivel was placed between the braided nylon and the monofilament lines. Neither of the arrangements used was satisfactory and for sets 10 to 20 they were replaced by a 9-foot gangion of 225 pound test monofilament with no swivels, identical to that for the Mustad hooks.

Hooks

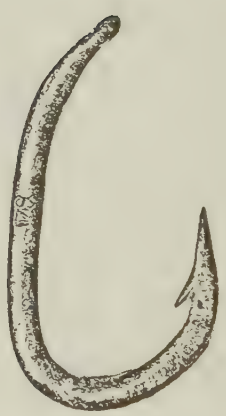
The Alaska used a combination of nos. 7 and 8 Mustad tuna circle hooks. The Temptation also used a combination of nos. 7 and 8 Mustad tuna circle hooks, but they were modified by offsetting the point by 1/8 to 3/16 inch. The Arrow used no. 8 Mustad tuna circle hooks and the Taasinge used no. 30 Japanese circle hooks on all sets. The Sea World used a combination of nos. 28 and 30 Japanese longline hooks on all sets except one where a combination of nos. 28 and 30 Japanese longline and 12/0 hooks was used. The Pacific Pioneer used a combination of no. 36 Japanese longline and no. 8 Mustad tuna circle hooks on all sets. Some of the hooks used for longlining are shown in Figure 4.

SAMPLE LONGLINE HOOKS

#7 MUSTAD CIRCLE

#8 MUSTAD CIRCLE

#30 JAPANESE CIRCLE



#34 JAPANESE LONGLINE

Figure 4. Hook types used during 1982 survey. Hooks are shown actual size. The #34 Japanese longline hook is just slightly larger than the #28 and #30 used by the Sea World and somewhat smaller than the #36 used by the Pacific Pioneer.

Bait

Frozen squid, saury and mackerel were used for bait. The squid were 4 to 10 inches long and counted 4 to 8 per pound. The saury were 8 to 10 inches long and counted 5 or 6 per pound. The mackerel were 6 to 10 inches and counted 1 to 4 per pound. The Alaska, Arrow, Taasinge and Temptation used squid as bait on all hooks on all sets. The Sea World used a combination of squid and mackerel (3:1) on 8 sets and all squid on 5 sets. The Pacific Pioneer used a combination of squid and saury (1:1) on 7 sets and squid only on 13 sets. (See Appendix 1.)

There were differences in the baiting methods used by the vessels. The Arrow and Sea World baited during the set and no bait was reused. Only squid of appropriate size were used. On the Taasinge hooks were baited prior to the first set and for the remainder of the sets the hooks were baited during the haul of the previous day's set. The first 500-600 hooks baited during the haul were left on the stern overnight and were the first to be set the next morning. The remainder of the baited gangions were refrozen in the hold and removed as required. About 60 percent of the bait was reused on sets 7, 9, 11, 12 and 14 with only partial baits that had been bitten during the previous set removed. On sets 17 to 22 bait was reused only if it appeared very fresh, excluding cloudy eyes, which amounted to about 20 percent reusable bait. On the Temptation hooks were baited prior to the first set and for sets 2 to 5 the hooks were baited during the haul of the previous day's set and refrozen until used. On sets 1 to 4 no baits were reused; however, on set 5 some baits in good condition were reused. On all sets after no. 5, hooks were baited during the set and no bait was reused.

SETTING THE LONGLINE

All the vessels stored the main line on longline reels and set the line from the stern. The drum of the winch was allowed to freespool while setting the gear and the tension regulated by a friction brake. Buoy lines were attached to the main line by a salmon snap. On most of the vessels the buoys, flags and radar reflectors were put over the side from the corner of the stern after the line had been paid out. The Sea World experienced fewer tangles when snapping the buoy line on the main line after releasing the floats, flags and radar flectors over side and paying out the line. The opposite was experienced on the Temptation when experimenting with both methods.

On vessels where the hooks were baited during the haul of the previous set, the containers holding the baited gangions were placed near the stern and two men were used for attaching the baited gangions to the main line. On those vessels where baiting was done during the set, either 1) the bait was placed on a baiting table or trough near the stern with the containers holding the gangions nearby and two men would do baiting of the hooks and attach the gangions to the main line; or 2) the hooks would be baited by one crewman, then baited gangions in containers were placed near the stern where two crewmen attached them to the main line. It was necessary for the crewmen that were baiting to wear waterproof gloves in order to prevent sores and infection on their hands caused by excessive contact with he juices from the squid used for bait.

The boats proceeded at a speed of 5 to 8 knots while setting the gear and less than two hours were usually required to complete each set. Most of the sets were started near dawn between 0700 and 0800 PST. Some sets were made at night. The direction that the gear was set varied depending on sea and wind conditions and was also varied to test the relation of fishing success to the direction of set. Information concerning setting the gear is given in Appendix 1.

HAULING IN THE LONGLINE

The haulback was started 2 to 4 hours after the last buoy was set. The last basket of gear set was picked up first on the Temptation, Pacific Pioneer and Alaska, and the first basket set was picked up first on the Arrow and usually on the Taasinge and Sea World (see Appendix 1). The gear was retrieved near the midship usually at a vessel speed of about two knots. A line hauler was used to pull the main line on the Arrow and the hydraulic reel was used on all the other vessels. Buoy lines were hauled using a hydraulic tuna line puller or net puller. The main line was brought over a fairlead roller attached to the rail and led through a block(s) to the puller or reel.

The speed of the vessel and the puller or reel were adjusted in attempts to reduce tension on the main line; however, this was not always successful. Excessive strain on the main line caused it to part in some instances. Excessive strain also seemed to cause both types of main line materials (twisted halibut line and braided nylon) to twist as it was hauled. The twist appeared to be imparted, at least in part, by the fairlead roller. The greater the tension on the line, the more twist imparted to it. The turning of the main line resulted in gangions twisting along the line, especially when they broke the surface of the water. Twisted gangions were stripped off by unclipping them and then pulling at 90° to the main line until they were free. This slowed the hauling operations as they did not always clear, and often caused damage to the gangion material (kinks, knots, etc.). In addition, fish on those gangions that twisted about the main line sometimes broke free or fell off at the boat (see Appendix 1). On the Sea World the gangion snaps were spread slightly so that they gripped the main line lightly. This did not prevent all gangions from twisting during the haul; however, fish on the gangion placed sufficient strain on the snap so that the main line rotated within it and the fish was not wound up tight to the line and broken off. Virtually all fish caught on the Sea World came up with the gangion clear of the main line. Knots placed every 60 feet in the main line acted as stops to prevent the fish from pulling the snap down the line.

Albacore and bigeye tuna that were caught on the longline were usually brought on board the vessels with a gaff. The time required to complete the hauling operations ranged from about 8 to 12 hours (see Appendix 1).

TROLLING

The vessels used conventional albacore trolling jigs and usually trolled in a straight line without circling except on a few occasions. Each vessel trolled from 6 to 10 lines from about dawn to dusk, 10 to 12 hours per day, while in transit to and from the area where longline fishing was centered (see Figure 1). The Sea World and Taasinge usually trolled in the vicinity of the longline gear while the gear was "soaking."

SCIENTIFIC OBSERVATIONS

Acoustic Tracking of Albacore

Acoustic tracking experiments were conducted to make measurements of albacore depth distribution and to determine albacore-ocean temperature relationships. The Sea World was equipped with a hydrophone and receiving equipment for tracking albacore tagged with ultrasonic transmitters. The scientists on board the Sea World and the Taasinge carried acoustic tags to increase the chances of tagging and tracking albacore in the offshore area. Two albacore were tagged during the charter and tracked by the Sea World.

Ocean Temperature Measurements

Vertical profiles of ocean temperature down to approximately 1500 feet were measured with an Expendable Bathythermograph (XBT) System (Sippican Mark 4 Recorder and T4 Probe). XBT drops were made by each vessel[2] usually once a day when troll fishing was conducted, and up to several XBT drops were made in conjunction with each longline set. Sea surface temperature (SST) measurements were monitored frequently on the vessels using electronic thermometers with readouts in the wheelhouse or using a bucket thermometer.

Fish Tagging

Floy spaghetti-dart tags were used to tag a selected number of albacore. Fork length measurements, to the lower whole centimeter, were made on each fish tagged and released, and the position, date, and SST were also recorded.

Records of Catch and Effort

Records of the longline fishing were kept on each vessel. These records usually included: date, times and locations at the start and completion of the set, haulback time, number of baskets of main line used, depth of buoy lines and distance between buoy lines, quantity and type of materials, lengths of gangions, type of bait, and weather and sea conditions. In addition, special records were kept on the Sea World, Tassinge and Temptation for each hook as the longline was hauled. This information included presence or absence of bait on the hook, hook lost or straightened, species of fish caught, observed loss of fish during hauling and malfunctions in the gear.

On days when only troll fishing operations were conducted, records were kept on the date, times and locations at the start and finish of trolling, and numbers of fish caught. When trolling was conducted in conjunction with a longline set, only the general location of the trolling and total number of fish caught were recorded.

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[2]The XBT on the Temptation functioned intermittently in the cruise and the one on the Alaska was not used because of failure of the auxiliary engine on the vessel.

Size Measurements of Tuna

On the Sea World, Taasinge and Temptation fork length measurements were made on all albacore and bigeye tuna caught. On the other vessels fish weights were estimated and the range and predominant size noted for each day's catch.

Other Observations

Surface weather observations were recorded in conjunction with XBT drops and longline sets. Incidental sightings of marine mammals and shore birds were noted, however, no regular watch was maintained to make these types of observations. In addition, albacore eye samples were collected from 125 fish for biochemical analysis in a study investigating stock structure of the North Pacific albacore population. Also, albacore blood samples were collected for other biochemical studies.

RESULTS

ALBACORE CATCHES MADE BY LONGLINE

Albacore Catches by Number and Weight

A summary of the longline catch and effort of albacore and bigeye by vessel is given in Table II. The catch of albacore by longline for all vessels was approximately 66,000 pounds. An additional 4,900 pounds of albacore was taken on trolling gear for a total albacore catch of 70,939 pounds. By vessel, the albacore catch ranged from 5,022 pounds to 22,564 pounds. In numbers there was a total of 3,418 albacore taken in 112 longline sets. Hook rates ranged from 1.6 to 4.8 albacore per 100 hooks. The group average was 3.2 albacore per 100 hooks or 3.4 albacore plus bigeye per 100 hooks.

Geographical Variations

Summaries of longline catch and effort for albacore by 1/2-degree squares in the area where the longline fishing was centered are shown in Figure 5. The top panel of the Figure presents the number of sets, the mean catch per 100 hooks, total catch in numbers of albacore and total number of hooks fished. The bottom panel of the Figure presents the range in number of albacore caught during individual sets, the average number of albacore caught per set, and the average number of hooks set; the 1/2-degree squares where only a single set was made are also indicated.

The hook rate varied from a high of 5.1 albacore/100 hooks to 0 in the case of one surface set made by the Sea World near 30°N and 138°W. Other low catch rates tended to be south of 30°30'N, however, these rates are based on single sets. Seventy percent of the total catch was taken in eight of the

Table II. Summary of Fishing Results From 1982 Albacore Longline Project

Vessel	No. of Sets	Range of Hooks/Set	Range No. Alb./Set	Avg. Alb./ 100 Hooks	Total No. Alb.	Total No. BE	Total Wt.** Alb. (lbs.)	Total Wt. BE (lbs.)	BE as % Total Wt.
Alaska	20	288-1050	1-136	3.5	587	17	10583*	817*	10*
Arrow	20	720-1400	8-110	4.8	1144	38	22564	1710	7
P. Pioneer	20	480-1050	1-76	2.8	505	58	13310	2140	14
Sea World	13	382-1059	0-49	2.7	276	9	7060	404	5
Taasinge	23	282-1684	2-84	2.8	695	35	12400*	1683*	10*
Temptation	16	229-1040	0-35	1.6	211	24	5022*	1080*	18*
Totals	112	---	---	---	3418	179	70939	7834	

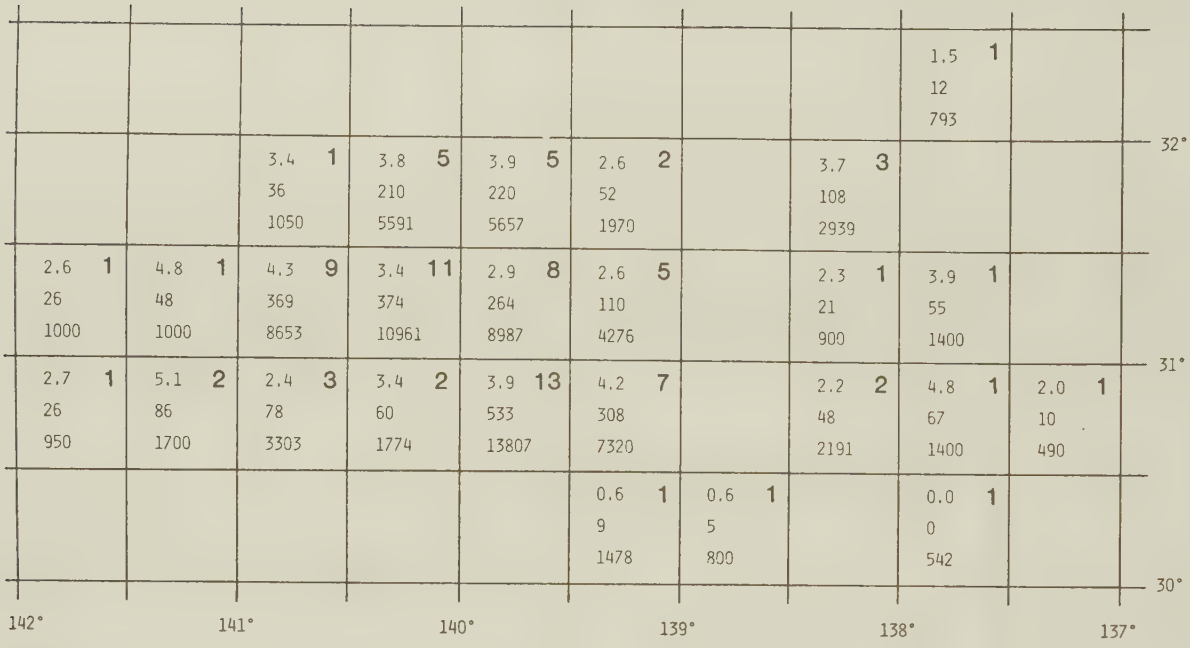
*Albacore and bigeye were weighed together. Weights for each species were estimated from the numbers of each caught and their average weights.

**Weights of albacore include troll caught fish which account for 7% of catch.

SUMMARY OF LONGLINE CATCH AND EFFORT
BY 1/2-DEGREE SQUARES

KEY

NUMBER OF SETS
CATCH/100 HOOKS
TOTAL CATCH
TOTAL NUMBER OF HOOKS



KEY

RANGE IN CATCH
AVERAGE CATCH
AVERAGE NUMBER OF HOOKS

* ONE SET

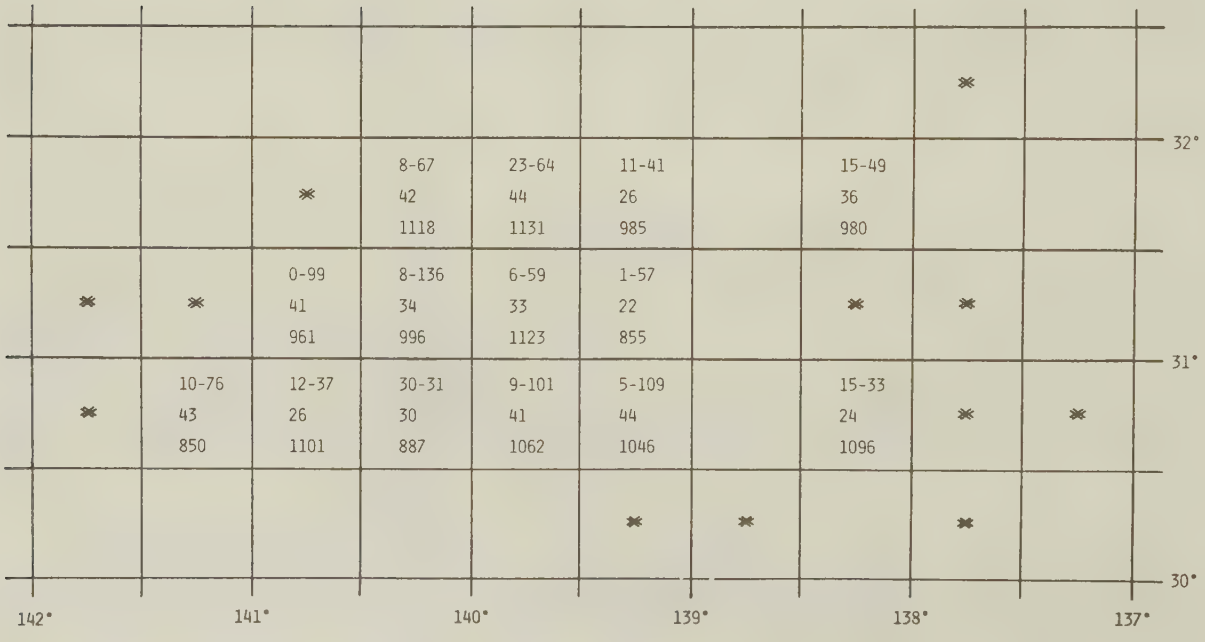


Figure 5. Summary of longline catch and effort by 1/2 degree squares for all boats.

1/2-degree squares where sixty percent of the effort was concentrated. The fishing vessels tended to converge toward the vicinities of the one or two vessels which had highest catches. This action resulted in an uneven distribution of effort over the area. Consequently conclusions about the distribution of catches and hook rate by 1/2-degree squares within this limited area cannot be drawn with confidence.

Size Composition

The size composition of albacore caught by trolling and by longline aboard the Sea World, Taasinge and Temptation are shown in Figure 6. The troll-caught fish were smaller than the longline-caught fish. The troll-caught fish fell into about three size groups--about 7 to 9 pounds, 14 to 17 pounds, and larger. The longline-caught fish ranged in size from 7 to 60 pounds and were distributed mostly into three size groups--a small number of 7 to 10 pound fish and mostly 14 to 18 and 21 to 28 pounds.

There were some differences in the mean weight of fish caught by the individual vessels with the Alaska, Arrow and Taasinge having a mean weight of about 18 pounds and the Pacific Pioneer, Sea World and Temptation about 25 pounds.

Fishing Depth of Longline Gear

The operative fishing depth of the longline gear is influenced by a number of factors including the length of buoy lines, use of weights, effectiveness of floats, weight of fishing equipment on the main line, and currents. In an attempt to measure the sinking rate and final configuration of the main line one or two depth recorders (bathykymographs) were attached on most longline sets made by the Taasinge. Unfortunately the maximum depth reading of these devices was 660 feet and the center of the main line dropped below this level when 600 foot buoy lines were used. When using 400 and 450 foot buoy lines, the mainline would most often settle near the 660 foot mark or drift below. The same depth was sometimes reached when alternating 300 foot buoy lines with longer ones. It is evident, therefore, that the sag in the main line may often reach 250 to 300 feet below the depth of the buoy lines. Alternately, there were some sets in which the gear must have streamed out at an angle due to subsurface currents or tangled such that only intermediate depths were recorded. Figure 7 shows a schematic of an 1800 foot basket with an estimated 250 to 300 foot sag. When no currents affected the gear, 80% of full depth was attained in the first half hour. In subsequent hours the gear would sink deeper.

Distribution of Catches Along Longline

The catch of albacore was found to be distributed along the longline in a variety of manners. In some sets, fish were evenly distributed, in others they were clumped along part of the longline. The albacore and bigeye tuna catches by basket are given in Tables IIIa to IIIf for each of sets of all vessels. The tables were drawn to be symmetrical for easy intercomparison; the catch numbers were spaced according to the length of each basket.

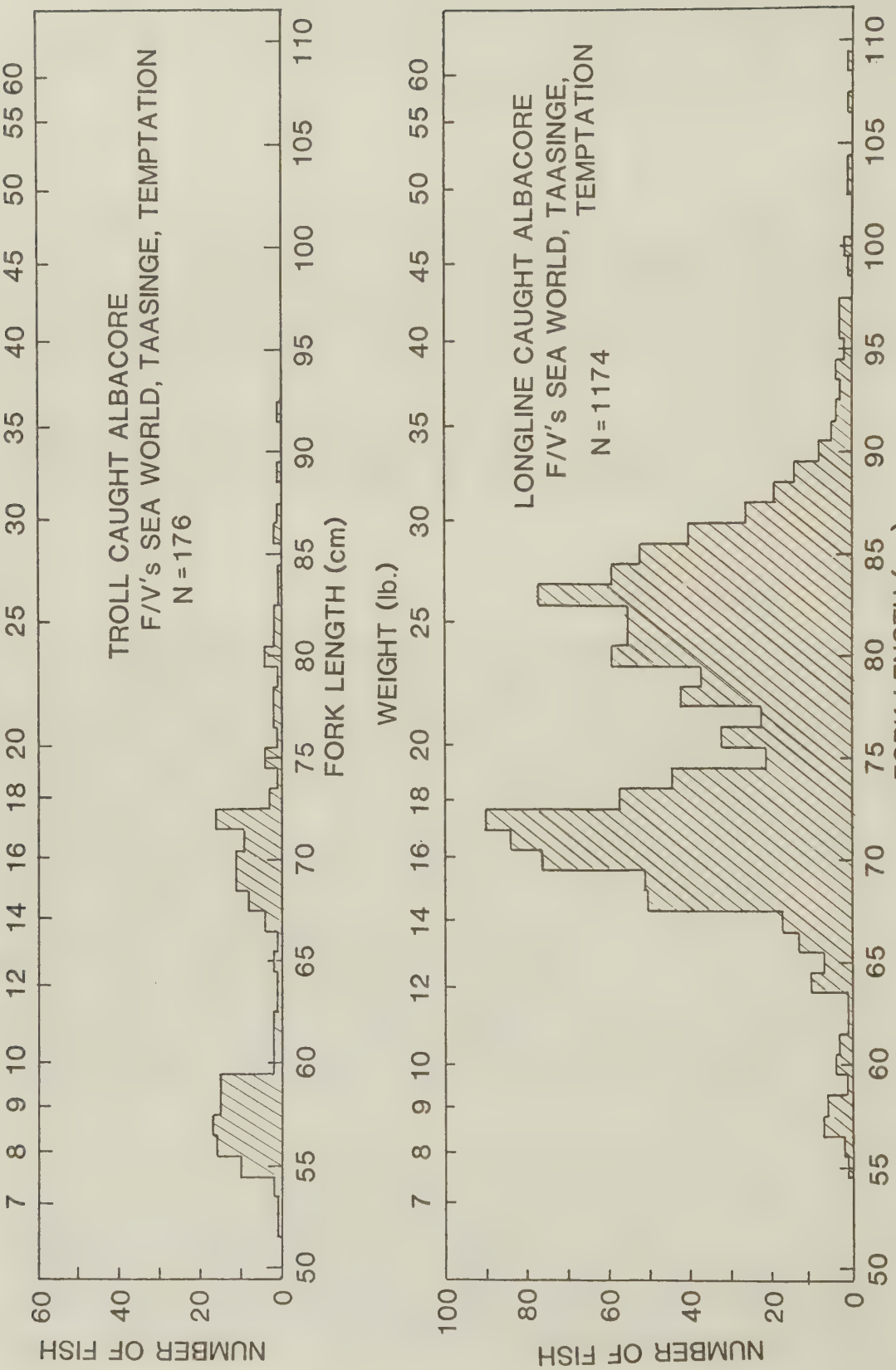

TROLL CAUGHT ALBACORE
F/V's SEA WORLD, TAASINGE, TEMPTATION
N = 176
WEIGHT (lb.)
7 8 9 10 12 14 16 18 20 25 30 35 40 45 50 55 60
FORK LENGTH (cm)
50 55 60 65 70 75 80 85 90 95 100 105 110
NUMBER OF FISH
0 20 40 60
LONGLINE CAUGHT ALBACORE
F/V's SEA WORLD, TAASINGE, TEMPTATION
N = 1174
WEIGHT (lb.)
7 8 9 10 12 14 16 18 20 25 30 35 40 45 50 55 60
FORK LENGTH (cm)
50 55 60 65 70 75 80 85 90 95 100 105 110
NUMBER OF FISH
0 20 40 60 80 100

Figure 6. Length frequency composition of troll-caught albacore (upper) and longline-caught albacore (lower) on the three vessels with scientific observers.

Figure 6

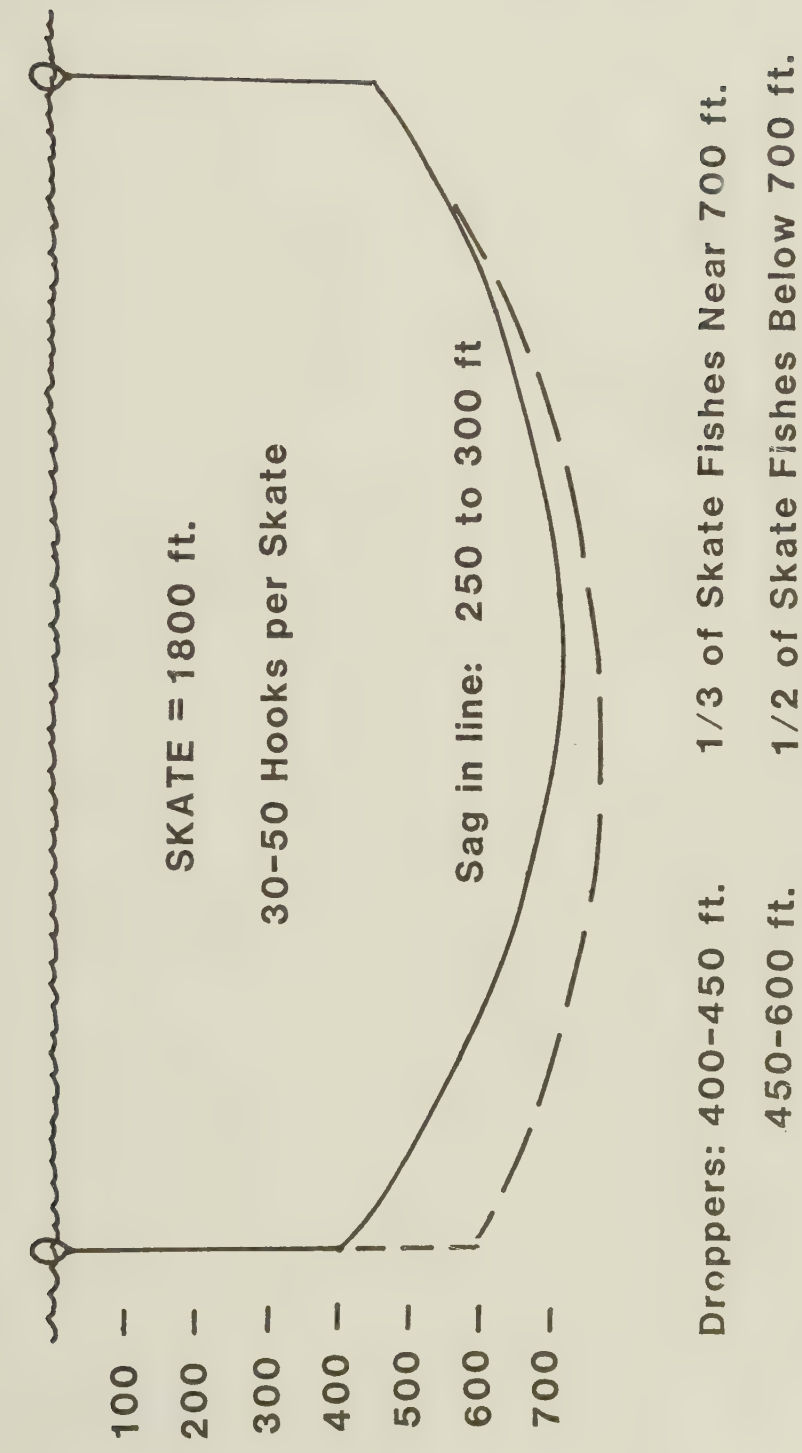


Figure 7. Schematic showing the fishing depth of an 1800-ft. basket (skate) with 250 to 300 feet of sag between 450-feet and 400 or 600-feet buoy lines.

Table III a

F/V ALASKA

Date	Set No.	Average No. Hooks per Basket	Albacore Catch by Basket (Bigeye catch in parentheses) Length of Basket = 1800 ft. Each "-" indicates zero catch		Total Albacore (Bigeye) Per Set
Jan. 17			In Transit		
Jan. 18	1	36	- - - - - 1 - -		1 (0)
Jan. 19	(no set)		In Transit		
Jan. 20	2	36	No Record This Set		6 (0)
Jan. 21	3	36	- 1 1 1 1 3 5 3 - 3 - 3 - 1 - 1 - - - - 4		27 (0)
Jan. 22	4	36-60	1 - 1 2 - - - - - 1 - 4 - - 3 - - - 2 1		15 (0)
Jan. 23	5	37	2 1 2 1 1 1 2 1 - 2 2 4 5 5 4 - 6 4 - 2 1 3		49 (0)
Jan. 24	6	38	Record Incomplete This Set		31 (0)
Jan. 25	7	-	No Record This Set		11 (0)
Jan. 26	8	40	1 - 1 - - - - - - - - - - - - - 1 1 2 1 3 1 4 - -		15 (0)
Jan. 27	9	40	1 1 - - - 1 2 2 2 4 2 1 1 2 1 2 2 3 2 4 2 2 4 - - -		41 (0)
Jan. 28	10	40+	- - 2 2 2 1 1 3 3 2 1 1 1 3 2 2 5 1 4 1 2		39 (0)
Jan. 29	11	40+	2 1 2 2 2 - 1 1 - - - 2 1 2 1 2 2 - 1 -* -* -*	(1 unaccounted for)	23 (0)
Jan. 30	(no set)		Rough Weather		
Jan. 31	(no set)		" "		
Feb. 1	(no set)		" "		
Feb. 2	12	43+	3 1 2 1 - 1 1 0 1 0 2 1 - 1 1 - - - 1 (1)	(1 unaccounted for)	17 (1)
Feb. 3	13	43	- - - - 1 - 1 1 2 1 2 - 1 - - - 2 - - - 1 1 (2)		13 (2)
Feb. 4	14	35+	2 - - 1 - 3 - - 1 4 - - 2 5 2 1 - 2 1 - - 2 1 2 1 (4) (1)(1)		30 (6)
Feb. 5	15	45	3 3 4 4 3 3 1 1 1 3 1 - -		27 (0)
Feb. 6	16	-	5 6 4 3 9 8 5 6 9 8 10 9 6 5 9 8 4 5 6 2 3 1 2 2 1 (1)		136 (1)
Feb. 7	17	42	- 2 4 4 1 - 1 - 1 - 1 - 4 - 1 1 - 2 - 1 1 - 2 1 2 (1)		29 (1)
Feb. 8	18	-	- 1 1 - - - 1 - - - 2 1 - 1 - - - - 1 -		8 (0)
Feb. 9	19	-	Record Incomplete - - - - - - - - 2		5 (5)
Feb. 10	20	-	- - 1 6 4 5 2 3 4 2 6 3 2 2 2 3 2 3 2 1 2 3 (1)	(6 unaccounted for)	64 (1)

*Set down by foreign vessel.

Total Albacore 587

Total Bigeye (17)

Table III b

F/V ARROW

Date	Set No.	Average No. Hooks per Basket	Albacore Catch by Basket (Bigeye catch in parentheses) Length of Basket = 1800 ft or 3600 ft. (indicated by *) Each "-" indicates zero catch	Total Albacore (Bigeye) Per Set
Jan. 17			In Transit	
Jan. 18			" "	
Jan. 19			" "	
Jan. 20			" "	
Jan. 21	1	40	1 1 - 3 1 1 1 3 - - 1 - 2 - 1 2 1 4 6 6 2 3 2 1 1 3 3 2 3 5 2 2 2 2 (1) (1) (1)	67 (3)
Jan. 22	2	40	3 1 2 2 1 2 1 1 1 3 1 2 - - - 3 1 - 2 - 5 1 2 1 2 1 2 1 4 1 - 1 2 4 2 (1)	55 (1)
Jan. 23	3††	80	1* 2* 1* 1* 1* 2* 2* 2* 1* 3* 4* 2* -* 3* 4* 1* 3*	33 (0)
Jan. 24	4	80	7* 4* 3* -* 1* 2* 3* 1* -*	21 (0)
Jan. 25	5	80	1* 3* 4* 2* 2* 5* 5* 5* 3* 1* 3* 3* 6*	43 (0)
Jan. 26	6	40/80†	1 - 4 2 5 5 2* 9* 5* 6* 2* 8* 10* 8* 9* 9* 9* 6* 4* 3* (1) (1)	109 (2)
Jan. 27	7	40/80†	1 3 4 - 1 5 1 2 1 3 2 4 - - 3 6* 1* 3* 3* 4* 4* 2* -* 2* 1	56 (0)
Jan. 28	8	40/80†	3 2 1 1 2 1 2 5* 5* 2* 2* 1 4* 2* -* 1 7* 3 5 1 3 2 1 1 (1) (1) (1)	57 (3)
Jan. 29	9	40/80†	4 3 3 1 - 7 4 4 4 6 7 6 2 2 4* 3* 2* 1 2 3 1 4 2 2 2 2 5 6 5	101 (0)
Jan. 30	(no set)		Rough Weather	
Jan. 31	(no set)		" "	
Feb. 1	(no set)		" "	
Feb. 2	10	40	2 1 1 1 2 2 4 - - - 2 2 1 2 3 2 1 1 3 - 1 2 - - - 1 - - - - (1) (1)	34 (2)
Feb. 3	11	40	2 - 1 1 1 3 - 2 2 3 1 5 4 3 1 5 2 2 1 2 1 3 2 1 - 1 1 1 3 (1) (1)(1)	54 (3)
Feb. 4	12	40	2 1 2 1 1 3 4 2 2 2 6 2 5 1 2 7 2 1 2 3 2 - 1 - - 1 2 2 - - 1 2 (1)	62 (1)
Feb. 5	13	40	1 - 4 - 3 4 1 1 4 1 3 6 3 3 4 2 1 1 1 - 1 5 - 6 4 - 3 2 1 2 (1)	67 (1)
Feb. 6	14††	40	- 1 1 - 1 2 5 2 - 2 1 4 4 2 4 3 2 2 3 2 3 2 5 2 1 3 (1)(1) (1)	57 (3)
Feb. 7	15	40	1 7 2 1 - 3 3 2 1 1 1 - 3 1 2 1 2 4 2 3 - 5 2 3 1 - - - 1 1 (2) (1)	53 (2)
Feb. 8	16	40	2 - - 1 - - - 4 1 1 - 2 - - 3 - 3 3 7 3 4 4 - 2 - 4 4 2 1 (2) (1)	51 (3)
Feb. 9	17	40	- 4 4 6 2 3 3 2 2 1 9 3 4 3 - 2 1 3 4 3 1 2 3 1 3 2 1 - 3 2 2 1 (1) (1) (1)	79 (4)
Feb. 10	18	40	5 2 3 3 2 2 2 1 4 2 1 3 1 3 3 3 4 3 3 5 10 2 3 4 3 2 2 2 5 5 2 4 (2) (2) (3)	99 (7)
Feb. 11	19	40	- 1 - 1 - - 1 - - 1 - 1 1 - - 1 1 1 3 4 4 1 3 1 4 1 3 - - 3 1 1 (1)(1)	38 (2)
Feb. 12	20	40	4 - - - 1 - - - - 1 - 1 - - - - 1 - - - - - - (1)	8 (1)

†40 hooks per basket for 1800 ft. basket; 80 hooks per basket for 3600 ft. baskets.

†† Part of set was set down by foreign longliner.

Total Albacore	1144
Total Bigeye	(38)

Table III c

F/V PACIFIC PIONEER

Date	Set No.	Average No. Hooks per Basket	Albacore Catch by Basket (Bigeye catch in parentheses) Length of Basket = 2700 ft. Each "-" indicates zero catch	Total Albacore (Bigeye) Per Set
Jan. 17	1	40	- - - 1 - 2 - - 1 - - -	4 (2)
				(1) (1)
Jan. 18	(no set)		Rough Weather; In Transit	
Jan. 19	(no set)		" " " "	
Jan. 20	(no set)		" " " "	
Jan. 21	(no set)		" " " "	
Jan. 22	(no set)		" " " "	
Jan. 23	2	50	- - 2 - - - 1 - - - 1 1 - - 2 -	7 (3)
			(1) (1) (1)	
Jan. 24	3	50	- - - 2 - 3 - - 1 2 1 2 - - 2 3	16 (2)
			(1) (1)	
Jan. 25	4	50	- 1 - - - - - - - - - - - - - -	1 (8)
			(1) (2) (3) (2)	
Jan. 26	5	50	- - - - - - - 2 1 - - 1 2	6 (5)
			(2) (1) (2)	
Jan. 27	6	50	- - - - 1 - 1 - - - 1 - - - - - - -	3 (2)
			(2)	
Jan. 28	7	50	- - - 2 1 - - 1 - 1 - 3 - - - - - 2 -	10 (3)
			(1) (1) (1)	
Jan. 29	8	50	- 1 3 1 1 - 4 - 3 - 1 4 3 - 2 1 - 2 -	26 (2)
			(1) (1)	
Jan. 30	9	50	- 1 - 1 1 - 3 - 1 2 - - - 1	10 (2)
			(1) (1)	
Jan. 31	(no set)		Rough Weather	
Feb. 1	(no set)		" "	
Feb. 2	10	50	- 2 - 1 1 - 2 - 2 4 5 2 1 3 3 6 2 3	37 (1)
			(1)	
Feb. 3	11	50	1 2 - 2 - - 1 - 2 - 1 - 1 - 2 - - - - -	12 (0)
Feb. 4	12	50	- 3 2 4 1 3 4 2 5 4 1 6 4 6 10 4 4 4 5 4	76 (10)
			(1) (1) (2) (1) (1) (2)	
Feb. 5	13	50	- 4 - 3 4 - 6 1 1 2 4 2 1 4 2 5 5 4 - -	48 (4)
			(1) (1) (1)	
Feb. 6	14	50	3 1 - 1 2 - 3 1 2 1 - 3 2 - 1 - 2 1 3 2	28 (4)
			(2) (1) (1)	
Feb. 7	15	50	2 4 2 2 6 3 1 2 4 2 2 3 2 3 1 3 5 2 4 6 (2 unaccounted for)	59 (2)
			(1) (1)	
Feb. 8	16	50	2 4 - 1 1 5 2 4 - 3 4 - 2 1 3 - 2 2 - -	36 (0)
Feb. 9	17	50	- - 1 - 2 - 1 2 2 1 - 1 3 2 - 1 4 1 3 2	26 (1)
			(1)	
Feb. 10	18	50	1 - 2 1 - 2 - 1 2 1 1 - 2 2 - 3 - 2 1 -	21 (4)
			(1) (1) (1) (1)	
Feb. 11	19	50	1 2 2 3 5 4 2 3 2 1 6 2 3 2 5 6 3 1 -	53 (1)
			(1)	
Feb. 12	20	50	2 1 3 1 2 - 2 3 2 1 - 2 3 - - 2 2 - -	26 (4)
			(1) (1) (1) (1)	

Total Albacore 505

Total Bigeye (58)

Table III d

F/V SEA WORLD

Date	Set No.	Average No. Hooks per Basket	Albacore Catch By Basket (Bigeye catch in parentheses) — Length of Basket = 1800 ft. Each "-" indicates zero catch	Total Albacore (Bigeye) Per Set
Jan. 17			In Transit	
Jan. 18			" "	
Jan. 19			" "	
Jan. 20	1	31	1 2 2 1 1 3 1 - 1 1 - - - - - - 1 - - 1	15 (0)
Jan. 21	2	32	- - - - 1 1 - - 2 - - - (1)	4 (1)
Jan. 22	3	32*	- 1 - 1 - - - 1 1 - - 1 - 2 1 1 - - - - 2 3 - - 1	15 (0)
Jan. 23	4	33	2 - - 1 - - 1 4 2 1 - 1 4 1 2 - - - 1 2 2 1 1 - - 5 6 1 2 3 2 -	45 (0)
Jan. 24	5	32	1 2 - - 1 - 1 2 1 1 1 - - - - (2) 1 3 1 - 1 1 1 2 4 1 1 2 - - - 1 -	29 (2)
Jan. 25	(no set)		Line in Wheel	
Jan. 26	6	31	- - - 1 2 3 1 - 3 3 2 - 1 - 4 5 5 3 4 1 4 1 1 - (1) - - 1 2 1	48 (1)
Jan. 27	7	33	- - - 3 1 1 4 1 1 1 - - 1 2 3 4 2 1 2 1 1 (2) - 3 5 - 5 1 3 - 2 - 1	49 (2)
Jan. 28	8	35	-* -* -* -* 1* 1* 1* 1* 1* 1 - - - - - - 2 1 1 1 (1) - 1 2 - - - 1 -	15 (1)
Jan. 29			Acoustic Tracking Project	
Jan. 30			Rough Weather	
Jan. 31			" "	
Feb. 1			" "	
Feb. 2	9	34	- - - 1 - - - 2 - - 1 - 2 1 1 - - - - - 2 - - - 1 -	11 (0)
Feb. 3	10	36	- - - 1 3 - - 1 2 1 1 1 1 - - - (2)	11 (2)
Feb. 4			Acoustic Tracking Project	
Feb. 5	11	34	- 2 1 - - 3 2 4 - - - - - - - - - 1 1 1 -	15 (0)
Feb. 6			Acoustic Tracking Project	
Feb. 7			Acoustic Tracking Project	
Feb. 8	12	28	- 1 - 1 - - - 1 3 1 1 - 2 - 2 1 - - - - 2 1 - 1 1 - - 1	19 (0)
Feb. 9	13	15	- - - - - - - - -

Table III e

F/V TEMPTATION

Date	Set No.	Average No. Hooks per Basket	Albacore Catch by Basket (Bigeye catch in parentheses) Length of Basket = 1800 ft. Sets 1-3; 3600 ft. Sets 4-16 Each "-" indicates zero catch	Total Albacore (Bigeye) Per Set
Jan. 17			In Transit	
Jan. 18			" "	
Jan. 19	1	30	- - - - - - - - - - - - - - 2 - 1 -	3 (0)
Jan. 20	(no set)		Trolling (10 Albacore)	
Jan. 21	2	27	- 2 - - 1 - - - - - - 1 2 - 2 1 1 - -	10 (0)
Jan. 22	(no set)		Trolling (2 Albacore; 1 Skipjack)	
Jan. 23	3	29	- - - - - - - - -	0 (0)
Jan. 24	(no set)		Trolling (no catch)	
Jan. 25	4	30	- - - 1 - - - -	1 (0)
Jan. 26	(no set)		Trolling (no catch)	
Jan. 27	5	30	- - 1 - - - 1 (1) 1 1 (1) - (1) Mainline Broke; Lost Gear	4 (3)
Jan. 28	(no set)		Looking for Lost Gear (9 Missing Baskets); Not Found	
Jan. 29	6	29	1 - - - - - - - - 1 1 -	3 (0)
Jan. 30	(no set)		Rough Weather	
Jan. 31	(no set)		" "	
Feb. 1	(no set)		" "	
Feb. 2	7	28	1 3 - - 2 1 (1) 1 1 1 - 1 1 1 - - - 1 (1)	13 (2)
Feb. 3	8	30	- - - - 2 1 1 1 3 4 2 1 2	17 (0)
Feb. 4	9	30	- 3 3 - - - 3 2 1 1 (1) - 2 - (1)	15 (2)
Feb. 5	10	39	- 3 - 1 7 4 4 2 4 1 2 1 2	31 (0)
Feb. 6	11	39	- - 3 (1) 1 1 2 3 1 - 1 1 1 -	17 (1)
Feb. 7	12	38	- - 1 1 1 1 - (1) - - - 1 3 1	9 (1)
Feb. 8	13	39	1 1 - 4 5 3 3 (1) 5 2 (4) 3 - 5 2 (1)	34 (6)
Feb. 9	14	40	- - 1 1 2 2 1 3 4 1 1 (3) - 2	18 (3)
Feb. 10	15	40	- 1 2 2 (2) 2 (1) 3 1 5 1 2 1 2 (2) 1	23 (5)
Feb. 11	16	40	- 1 1 - 2 3 - - 1 3 (1) 2 2	13 (1)

Total Albacore	211
Total Bigeye	(24)

Table III f

F/V TAASINGE

Date	Set No.	Average No. Hooks per Basket	Albacore Catch by Basket (Bigeye catch in parentheses) — Length of Basket = 1800 ft. — Each "-" indicates zero catch	Total Albacore (Bigeye) Per Set
Jan. 17			In Transit	
Jan. 18	1	31	- 1 - - - - - - -	1 (0)
Jan. 19	(no set)		In Transit	
Jan. 20	2	24	1 - - - - - - 1 - - 1 - - - - - - - - 1	4 (0)
Jan. 21	3	23	- - - - 3 - - - 2 2 - 1 - - 2 - 1 - 1 2 1 - - - - 1	16 (0)
Jan. 22	4	26	- - - - 1 - - - 1 - 1 - - 1 - - - - 2 (1) 1 1 - 2 - - - 1 - 1 -	12 (1)
Jan. 23	5	35	- 1 2 1 1 (1) 1 - - - 5 - 1 2 - 2 2 3 2 - - 2 2 1 1 1 2 4 1 (1) 2 4 - 1 (1) -	44 (3)
Jan. 24	6	34	1 - - 1 1 - - - 1 1 1 2 6 1 3 2 4 3 10* 7* 4 4 5 11 3 2 2 - 2 - 1	78 (0)
Jan. 25	7	37	1 2 1 1 1 2 1 2 1 1 - 3 - 1 - 3 - - - -	20 (0)
Jan. 26	8	35	1 - - 1 - - - - - - - 1 - - 1 - - - 1 2 - - - - - - 3 - - - 4 2 2 1 2 1 2 - 2 (1) 1 1 1	29 (1)
Jan. 27	9	37	1 1 3 1 (1) - 2 1 3 2 3 (1) 4 - 3 1 1 - - 8 4 5 (1) 3 3 - 3 6 1 4 5 2 3 (1) 3 2 3	81 (4)
Jan. 28	10	41	1 - - - (1) 3 - - - 1 1 1 2 1 1 - 2 3 1 - 4 (3) 6 - 3 2 5 1 - 4 2 2 2 - 6 1	55 (4)
Jan. 29	11	46	- 1 2 3 2 - 1 5 3 - - - 3 - - - 1 - 1 2 1 1 1 2 2 1 1	33 (0)
Jan. 30	12	33	- - - 1 1 2 - 1 1 1 1 1 - - - - - 1 1 - 1 1 3 4 - - - - (1)	20 (1)
Jan. 31	13	33	- - - 1 - - - 1 - 1 - - - - - - - - - 1 2 - -	6 (0)
Feb. 1	14	34	- - - - - - - - - - (1) 1 1 - - - 2 - 1 -	5 (1)
Feb. 2	15	40	- - 1 - - 2 1 - 2 1 - - - - - - - 1 1 - - - -	9 (0)
Feb. 3	16	45	1 - 4 2 2 2 2 - - - 1 2 - - 2 3 - 1 3 3 1 1 - 1 - - 1	32 (0)
Feb. 4	17	41	- 2 - 1 1 - - - 2 - 1 - 2 - - - - 1 - 1 - 3 5 4 2 1 2 - - (1) (2) (4)	28 (7)
Feb. 5	18	43	4 5 2 4 3 5 3 3 - 2 3 2 1 7 1 1 2 1 - 1 - - 1 1 - 1 1 2 - (1)	56 (1)
Feb. 6	19	41	2 - 6 - - (———— 18 ————) - 1 2 (———— 12 ————) 2 5 (— 5 —) 1 - - - - - - - - (1)	54 (1)
Feb. 7	20	43	- - - - - - - 1 2 - - 3 2 3 - 1 1 2 - 1 2 2 1 - 1 4 1 - - 2 - 1 1 2 2 - - - - - (1) (1)	35 (2)
Feb. 8	21	43	(———— 3 ————) - 1 (———— 3 ————) - - - - 1 (———— 5 ————) 3 1 - 1 - (2)	18 (2)
Feb. 9	22	48	- - 1 - - - - - 1 - (———— 3 ————) 2 1 1 - - (—— 1 ——) (1) (2) (3)	10 (6)
Feb. 10	23	47	2 - - 1 1 1 2 (3) 1 2 3 - 2 2 (———— 16 ————) - 1 - 5 1 4 2 - (1)	49 (1)

* Crossed by foreign longline.

Total Albacore	695
Total Bigeye	(35)

The following examples were selected from Tables IIIa to IIIf. For Taasinge set no. 6, having 31 baskets and a catch of 78 fish, over 80% of the catch was taken in 44% of the baskets. For Arrow set no. 1, having 34 baskets and a catch of 70 fish, 73% of the catch was taken in 50% of the baskets. In opposition to this clumped distribution, Alaska set no. 10, having 21 baskets and a catch of 39 fish, showed a very even spread. All baskets, but four, have 1, 2, or 3 fish. For Alaska set no. 16, having the highest catch of all, 137 fish (and 25 baskets), there was at least one fish in each basket. Those baskets with only 1 or 2 fish occurred at one end of the set. Those with 8, 9, and 10 fish were spread across 12 baskets.

The highest catches within one basket were 10 albacore and 2 bigeye tuna taken by both the Arrow (1800-foot basket) and the Pacific Pioneer (2700-foot basket). The Taasinge caught 11 albacore in one basket and the Alaska had 8 baskets of one set with 8 to 10 fish each. The record catch for the Taasinge of 11 albacore in a basket of gear includes 1 albacore lost at the surface, 13 lost baits, 4 twisted gangions, 3 broken hooks and 6 returned baits. Thus out of a total of 38 hooks, 32 show signs of fish activity.

A set of 25 1800-foot baskets may stretch across 5 to 7 nautical miles of ocean. The distribution of catches along the line seems to indicate that loose groupings of albacore either occur over an area of this magnitude, or move over this distance in the typical 5-10 hours soaking time of a set. However, there also appears to be small schools which occur individually or within the larger grouping.

In addition to the information on the distribution of fish by basket, records of the distribution of fish by each hook within every basket were kept on those vessels with scientific observers. The following summary of observations was drawn from an analysis of selected sets from Tables IIIa to IIIf and the records of catch by hook.

Among nine sets made by the Arrow in which baskets varied between 1800 and 3600 feet and buoys varied between 450 and 600 feet, there was a significant decrease in catch for the 3600-foot baskets with 600-foot buoy lines. These baskets could have sagged to a depth of 1000 feet. Similarly, a set from the Temptation showed a much lower catch rate and lower bait loss for the hooks near the 600-foot buoy lines than near the 450-foot buoy lines. These findings are interpreted to mean that the distribution of albacore is greater above depths near 600 feet, or above depths where temperature is about 56°F.

In four of the Temptation's sets with 3600-foot baskets, the catch rate and bait loss was greater nearer the buoy lines than in the center of the basket. The same result was derived for three Sea World sets (1800-foot baskets). Examination of five Taasinge sets for this factor produced mixed results. It is possible that the buoy line action caused by passing swells may translate to the bait and increase catch rates, but it remains in the realm of speculation. The differences cited may still be a function of depth or temperature.

Fish Loss

The scientific observers on board the Sea World, Taasinge and Temptation

kept records of each hook retrieved. Along with the fish caught, notes were made on bent, broken and lost hooks; gangions which were twisted or tangled by fish but the fish was lost (twisting like that made by bigeye and albacore); and albacore which were lost at the boat. Tables IVa to IVc summarize the data on lost fish as a percentage of total tuna caught by set for each of the three observed vessels.

The percentage of albacore lost at the boat is similar for all three boats; 5% on the Sea World and Taasinge, and 4% on the Temptation. These are fish that are missed with the gaff or pulled off when a gangion breaks the surface. Greater care in gaffing fish, particularly the use of a long-handled gaff, and keeping the main line near the vessel during hauling may decrease this loss.

The greatest difference among the three vessels in lost fish occurs in the incidence of tangled gangions. The Sea World experienced a 3% fish loss due to entanglement as opposed to 11% on the Temptation and 23% on the Taasinge. Twisted gangions occur when a hooked tuna swims in a circle on the end of the gangion and imparts twist to the monofilament until it begins to kink and knot up. The fish may also wrap the gangion on the main line. Eventually the gangion is shortened from 4-6 feet to 4-10 inches, and occasionally tight to the main line, giving the fish the leverage necessary to rip off the hook.

The Sea World had gangions equipped with a swivel at the snap and had spread the snap so that it would turn on the main line. The swivel prevented most fish from kinking the monofilament and the loose snap kept them from getting the gangion wrapped on the main line. The combination of the two modifications undoubtedly accounts for the difference between the Sea World and the other two observed vessels. The Alaska used gangions with swivels and snaps that grip tightly. Occasionally fish wrapped themselves on the main line to the extent that the swivels were neutralized and the fish twisted off; however, no accurate count of these was kept.

The Temptation had 3-1/2 times the gangion entanglement of the Sea World but only half that of the Taasinge. The main line on the Temptation was braided rather than twisted nylon, which may have resulted in fewer gangions wrapping up on the main line than the Taasinge. Also, the gangions on the Temptation were primarily 5-6 ft of 220 lb. test monofilament while those of the Taasinge were 4-5 ft of 300 lb. test monofilament. The lighter monofilament is softer and tends to kink up less easily than the heavier test; the increased length might also help decrease kinking.

The Taasinge used snaps which held fast to the main line, and 4 to 5 foot gangions of 300 lb. test monofilament, selected because it was easy to clear when twisted on the main line. The gangions did not have swivels. The main line was twisted nylon halibut groundline. This combination of short, stiff gangions lacking a swivel, and a snap tightly gripping a main line of twisted nylon produced the largest observed loss due to twisted gangions, 23%.

The percentage of lost or broken hooks is a function of hook type, twisting or entanglement of the gangion, and sharks and other large fish. The Sea World, using #28 and #30 Japanese longline hooks, had no bent or broken hooks but 6%[3] broken leaders. The Taasinge used #30 Japanese circle hooks with 11%[3] lost, bent or broken and the Temptation had 9%[3] loss with #7 and #8

Table IVa. Vessel Sea World

Set No.	# Alb.	# BE	SHK	# BH	# TG	#LA	TG & LA / Tot. Tuna	TG, BH, LA / Tot. Tuna
1	15	0	Y	5	1	3	27%	60%
2	4	1	Y	0	0	0	0	0
3	15	0	Y	2	1	3	27%	40%
4	45	0	Y	2	0	2	4%	9%
5	29	2	N	1	1	2	10%	13%
6	48	1	N	1	1	3	8%	10%
7	49	2	N	1	1	0	2%	4%
8	15	1	N	2	0	1	6%	19%
9	11	0	N	1	1	1	18%	27%
10	11	2	N	0	1	0	8%	8%
11	15	0	N	0	0	0	0%	0%
12	19	0	N	0	0	0	0%	0%
13	0	0	Y	1	1	0	X	X
Total	276	9		16	8	15		
Total Tuna = 285			Overall Average*	6%	3%	5%	8%	14%

*Expressed as a percent of total tuna caught, not of total hooks set.

BH = Bent, Broken and Lost Hooks
TG = Tangled Gangion (Most Likely a Tuna)
LA = Albacore Lost at Boat
SHK = Shark
Y = Yes
N = No

Six foot gangions of 180, 200# test monofilament, swivels on snap with snap spread to spin on main line. Main line 3-strand twisted nylon.

Table IVb. Vessel Temptation

Set No.	# Alb.	# BE	SHK	# BH	# TG	# LA	TG & LA Tot. Tuna	TG, BH, LA Tot. Tuna
1	3	0	Y	4	0	0	0	133%
2	10	0	N	2	3	0	30%	50%
3	0	0	N	0	0	0	0	0
4	1	0	N	0	0	0	0	0
5	4	3	N	1	1	2	43%	57%
6	3	0	N	2	0	0	0	67%
7	13	2	N	0	4	0	27%	27%
8	17	0	N	0	3	1	24%	24%
9	15	2	Y	1	3	1	24%	29%
10	31	0	N	4	5	2	23%	35%
11	17	1	N	3	3	0	17%	33%
12	9	1	N	2	1	1	20%	40%
13	34	6	N	0	2	1	8%	8%
14	18	3	N	0	0	1	5%	5%
15	23	5	N	0	0	0	0	0
16	13	1	Y	2	0	0	0	14%
Total	211	24		21	25	9		
Total Tuna = 235			Overall Average*	9%	11%	4%	15%	24%

*Expressed as a percent of total tuna caught, not of total hooks set.

BH = Bent, Broken and Lost Hooks
TG = Tangled Gangion (Most Likely a Tuna)
LA = Albacore Lost at Boat
SHK = Shark
Y = Yes
N = No

Five to six foot gangions of 220#, 250#, 300# test monofilament with no swivels. Main line braided nylon.

Table IVc. Vessel Taasinge

Set* No.	# Alb.	# BE	SHK	# BH	# TG	# LA	TG & LA / Tot. Tuna	TG, BH, LA / Tot. Tuna
1	1	0	N	1	0	1	100%	200%
2	4	0	Y	6	4	1	125%	275%
3	16	0	N	1	2	2	25%	31%
4	12	1	N	5	3	1	31%	69%
5	44	3	N	5	14	4	38%	49%
6	78	0	N	10	15	3	23%	36%
7	20	0	N	1	3	2	25%	30%
8	28	1	N	5	5	0	17%	34%
9	83	3	Y	6	23	1	28%	35%
10	55	4	N	3	18	2	34%	39%
12	21	1	N	1	4	0	18%	23%
13	6	0	N	2	1	0	17%	50%
14	5	1	N	3	1	0	17%	67%
15	9	0	N	3	2	1	33%	67%
16	32	0	N	0	4	1	16%	16%
17	28	7	N	0	11	2	37%	37%
18	56	1	N	3	8	2	18%	23%
20	34	2	Y	5	12	3	42%	56%
Total	532	24		60	130	26		
Total Tuna = 556			Overall Average**	11%	23%	5%	28%	39%

**Expressed as a percent of total tuna caught, not of total hooks set.

BH = Bent, Broken and Lost Hooks
TG = Tangled Gangion (Most Likely a Tuna)
LA = Albacore Lost at Boat
SHK = Shark
Y = Yes
N = No

*Five sets were excluded because no record was kept of hooks.

Four to Five foot gangions of 300# test monofilament and no swivels.
Main line 3-strand, hard-lay nylon halibut groundline.

Mustad circle hooks. The higher percentage of hook loss noted for the Temptation and Taasinge may be due to increased gangion entanglement allowing the fish leverage to bend the lighter hooks.

It appears that the use of swivels and spread snaps could increase catch rates by as much as 10%-23% by reducing the occurrence of twisted gangions. Greater diligence at the rail may increase catch by 1-2%. The use of heavier hooks to eliminate fish loss from bent/broken hooks might be undesirable as there is some question as to whether the lighter hooks might not have resulted in higher hook rates. The higher hook rates appear to be greater than the 3-4% loss due to bent hooks. Lighter hooks may also allow sharks to break loose rather than tearing up the gear.

The High Hook Rates of the Arrow

At a hook rate of 4.8 albacore per 100 hooks the Arrow scored well above the other vessels. It would be worthwhile to understand the factors that made the difference. Chance may have played, at least, a minor role in that their first set was on the mark at exactly their overall average hook rate. However, they had consistently high catches, and usually had higher fishing success than did the other vessels that worked in their vicinity. For the most part their choice of gear and operations were not unique to their vessel but the combination may have been. We have already stated that some of the other vessels could have improved their catches if gear modifications could have controlled losses by twisting of gangions, etc. Even so, they would not have matched the Arrow hook rates. One factor deemed to be important was the selection and treatment of bait. Fresh, recently thawed squid having bright clear eyes and of medium size was selected for each set. Secondly, their choice of no. 8 Mustad tuna circle hooks may have been a good choice.

Part of their operation which was not copied by the other vessels is that they operated slower (or took longer) to set and retrieve gear, which may have affected the effectiveness of the gear. In addition they always retrieved from the first buoy set. Except for the Taasinge, the Arrow often set a larger number of hooks. They usually completed their haul well into the hours of darkness. While we cannot clearly account for their higher hook rate, several or all of the factors mentioned may have made part of the difference.

COMPARISON WITH JAPANESE HISTORICAL CATCH RATE

The Japanese longline catch rates for albacore derived from data published by the Research Department, Fisheries Agency of Japan have been averaged for January and February of the years 1975 through 1979 and are given in Figures 8a and 8b. The catch rates of the appropriate 5- degree blocks are in the range 1.0 to 1.9 fish/100 hooks for January and 0.1 to 0.9 fish/100 hooks for February. Some 5-degree blocks to the west of the survey region fall in the range of 2.0 to 2.9 fish/100 hooks. The combined average for the

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[3]The hook damage in this paragraph is expressed as percent of the total catch, not as a percent of total hooks used.

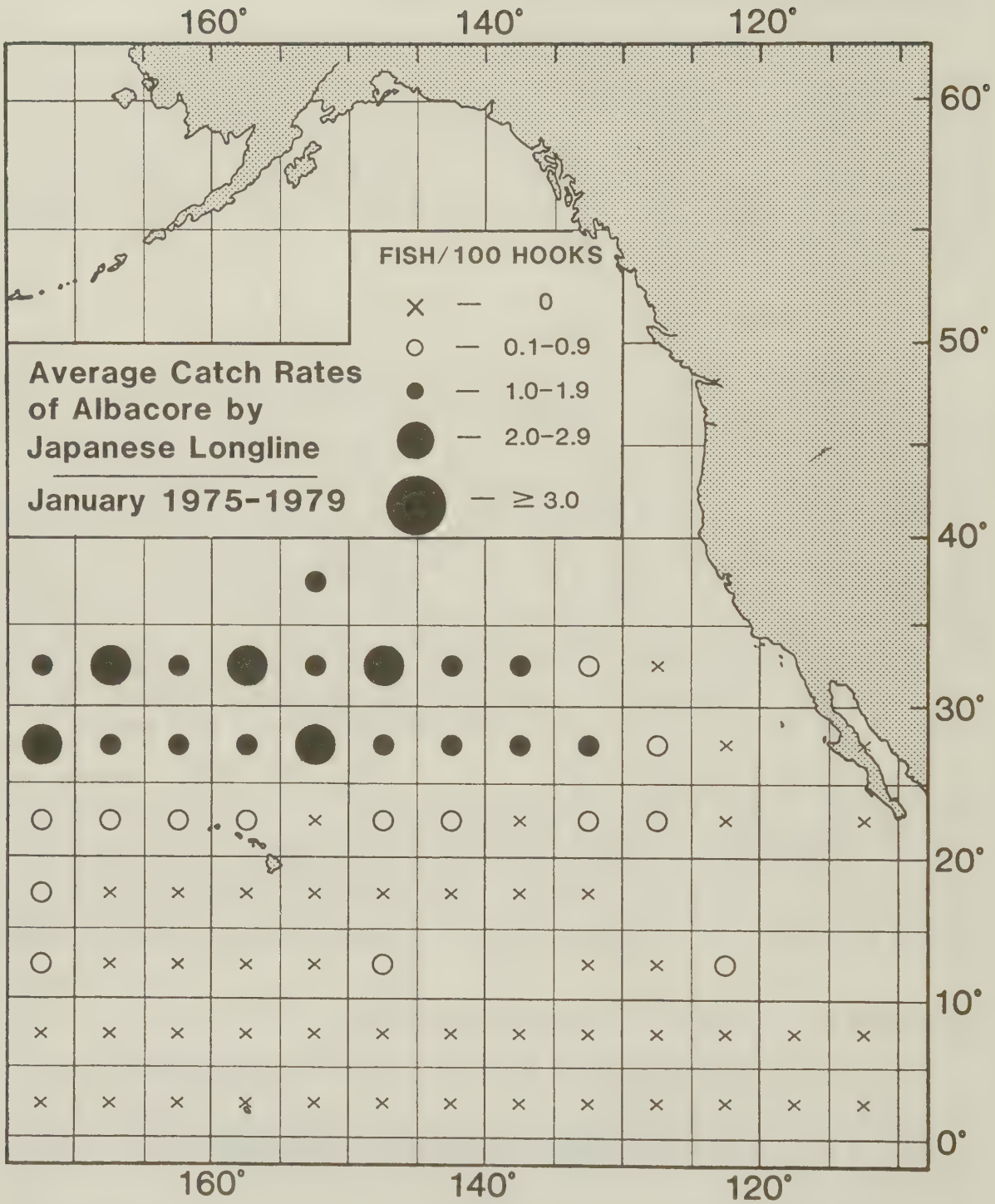

Figure 8a. Standardized catch rates during January of Japanese longline vessels averaged for the years 1975-1979.

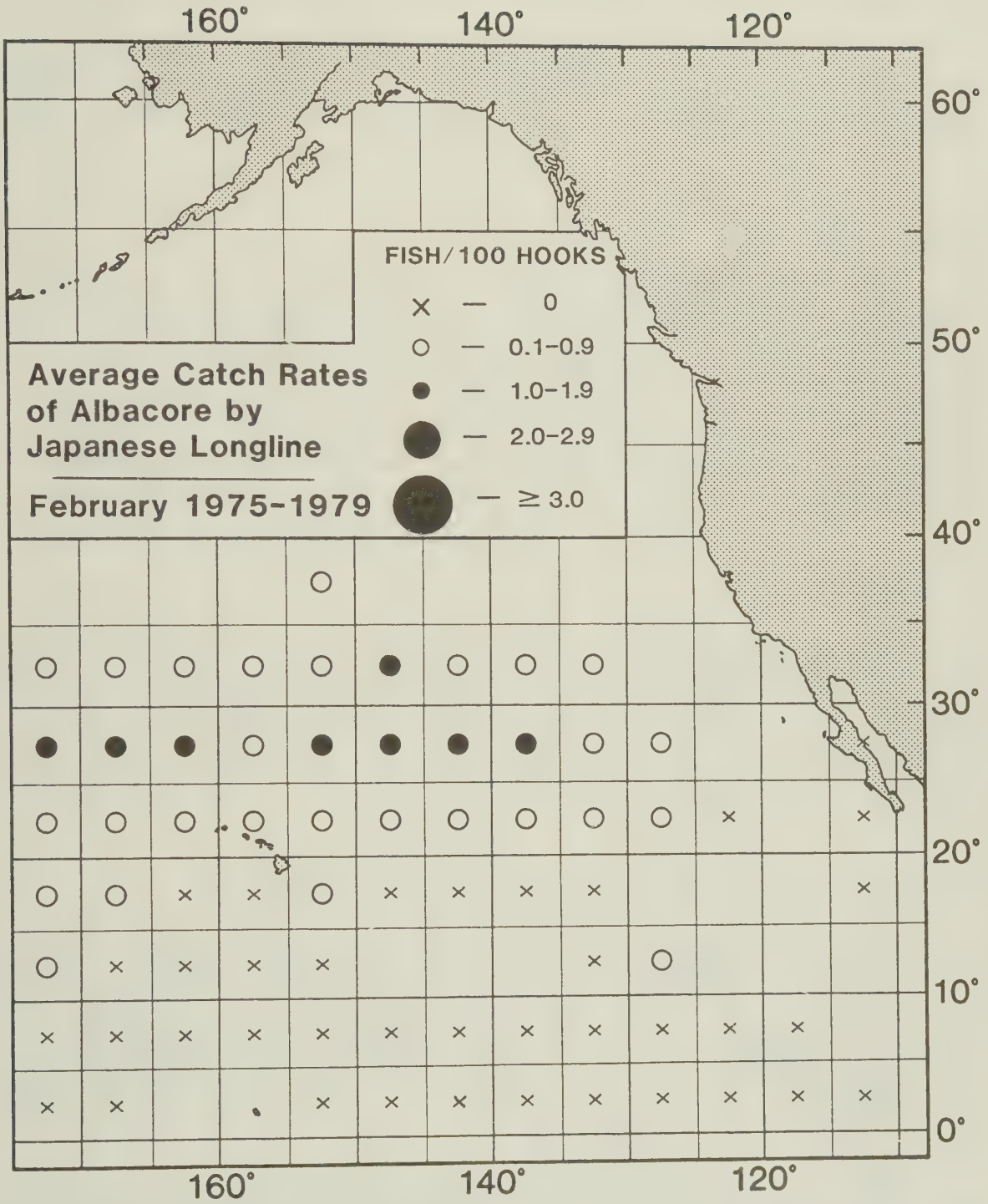

Figure 8b. Standardized catch rates during February of Japanese longline vessels averaged for the years 1975-1979.

six U.S vessels was 3.2 albacore/100 hooks which substantially exceeds the Japanese historical averages.

The Japanese longline catches show considerable variation among these years both in distribution of catches and in catch rates. Of the five years, the highest catch rates made in this region by the Japanese were 3.2 and 3.4 fish/100 hooks in 1979.

BIGEYE TUNA CATCHES MADE BY LONGLINING

Bigeye tuna comprised 11 percent of the total weight of tunas caught by longline. The range between vessels was 5% (Sea World) to an estimated 18% (Temptation). Historical longline catches made by the Japanese show that the geographic distribution of bigeye varies somewhat from albacore and that they tend to be distributed at slightly deeper levels than albacore. The Temptation was more consistent in setting its gear deeper than the other vessels. The second highest percent of bigeye was taken by the Pacific Pioneer which fished at more westerly longitudes than the other vessels. The bigeye as measured on three of the vessels ranged from 84 cm (26 pounds) to 123 cm (78 pounds). Modal size was 92 cm (33 pounds).

ALBACORE CATCHES MADE BY TROLLING

Information on catches of albacore made by trolling is given in Figures 9a and 9b. The area of best troll catches along the cruise track was between about 125° to 135°W. Eastward and westward of these longitudes catches were usually less than one-half of those between 125° to 135°W. The size composition of the troll caught fish is shown in Figure 6a. Troll catches accounted for an estimated 4,900 pounds or 7 percent of the total weight of albacore caught during the study.

ALBACORE CATCHES IN RELATION TO OCEAN TEMPERATURE CONDITIONS

Sea surface temperature ranged from 63° to 67°F and averaged 65.5°F within the area encompassing the major longlining effort, 30°30'N to 32°N and 137°W to 142°W. The average surface temperature was almost identical to the long-term average of 65.4°F. The depth to the top of the thermocline increased from 250 feet in the California Current to approximately 500 feet in the central longline area and decreased further west to 300 feet near 155°W (see Figure 10). This large-scale depression in the top of the thermocline is also evident in long-term averages.

Within the longline survey area the top of the thermocline was found to vary from 400 feet to slightly over 500 feet. The temperature structure of this area suggests a possible relationship to the longline catches. There was a relative shoaling (to 550 feet) of the 60°F isotherm where most of the catches were made. To the east and to the west the 60°F isotherm drops to greater than 600 feet before it rises again. This feature appears as a small rise in the larger scale depression of the thermocline in Figure 10.

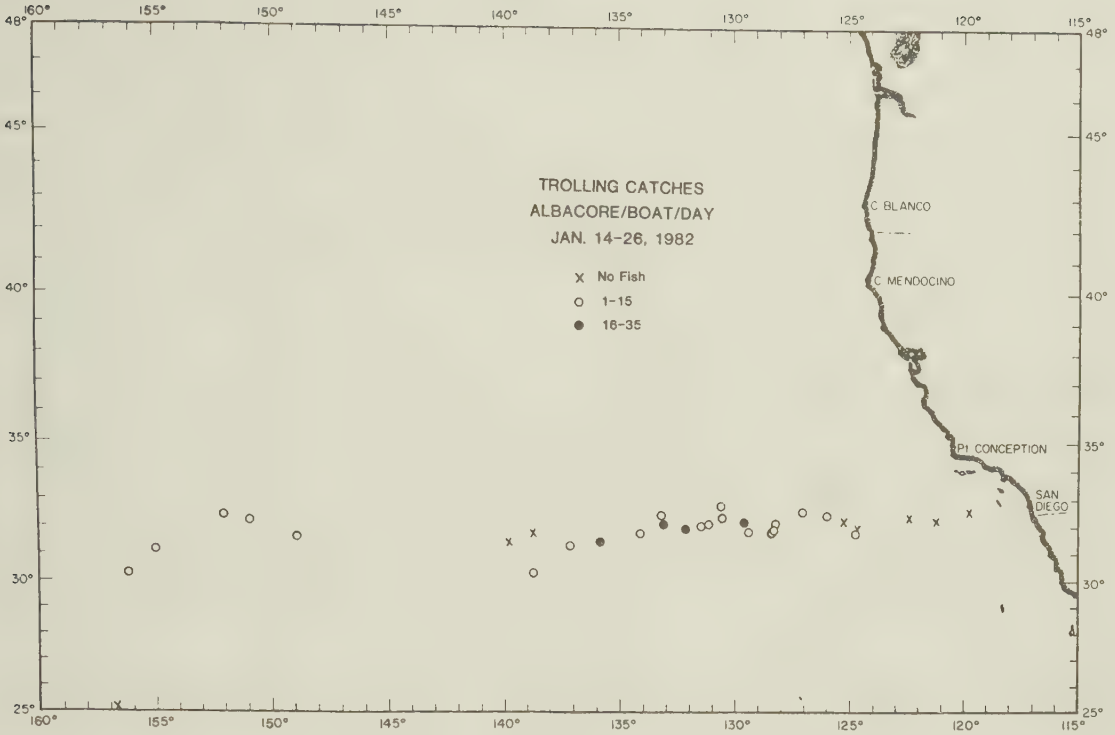

Figure 9a. Daily trolling catches of the six charter vessels outbound to longlining area.

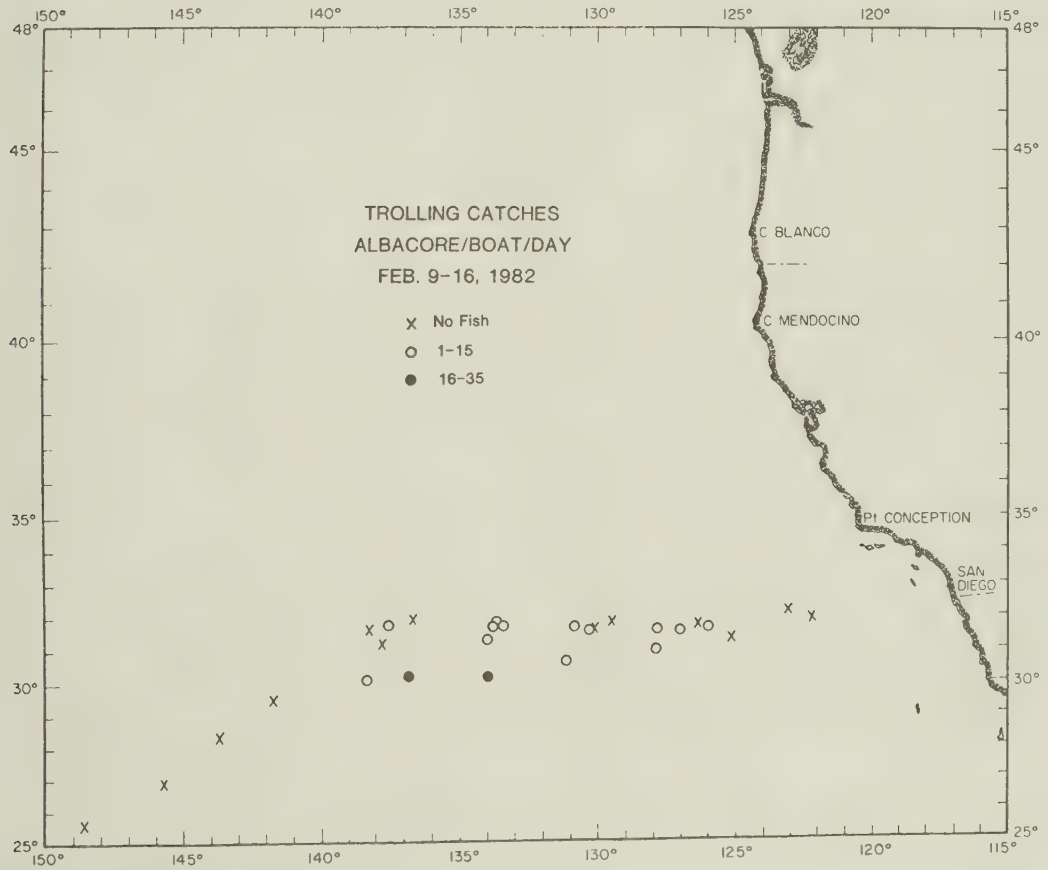

Figure 9b. Daily trolling catches of the six charter vessels during return leg of charter cruise.

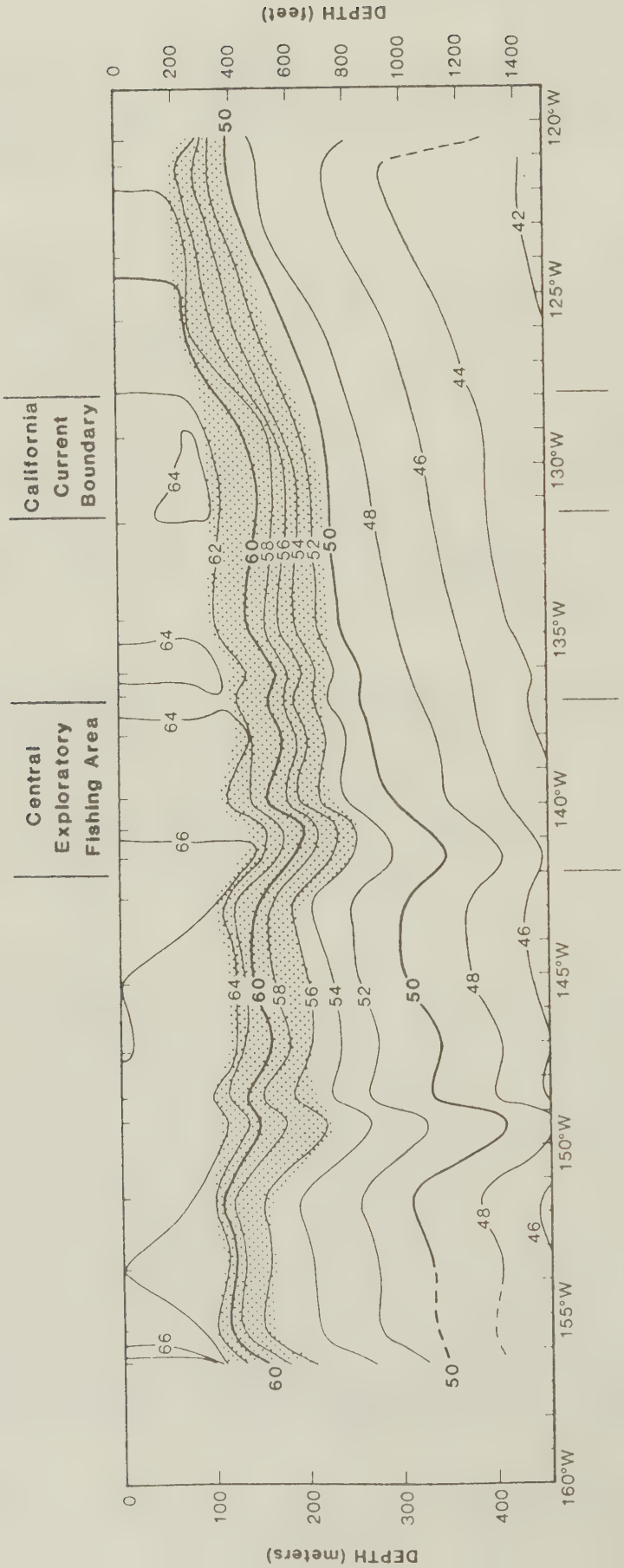

Figure 10. Temperature section along 31°30'North latitude from 120° to 160° West longitude as determined by expendable bathythermographs (XBTs) taken by charter vessels on the outbound leg of the charter. The shaded area is that part of the upper thermocline with the sharpest thermal gradient.

The significance of the feature is not known but may be related to a meander in the ocean current pattern. Overall the temperature structure is characteristic of subtropic waters and is thus south of the subtropic front frequently found near 32°N. The Pacific Pioneer crossed temperature fronts near 32°N at 150°W and again at 144°W which were likely to have been the subtropic front. This ocean feature appears to be important in the distribution of albacore.

On January 30 a storm system moved through the fishing area producing 30 to 45 knot winds and lasting three days. XBT casts taken at nearly the same location before and after the storm (Figure 11) show the effect of several days of high winds. Turbulent mixing deepened the surface mixed layer by 180 feet and fractionally lowered its temperature. The resulting thermocline on February 2 is deeper and sharper. We anticipate that such time changes and equivalent spatial differences in the temperature structure influence the vertical distribution of albacore. These changes point out the need to measure the vertical temperature structure.

Representative albacore catches for 10 sets (from the Arrow and Taasinge) are shown plotted on a vertical section of temperature in Figure 12. The temperature section, drawn from XBT casts made on the day of each set, is oriented nearly north-south and cuts across the region where longlining effort was concentrated. The thermocline is shaded and the vertical line indicates the fishing depth of the gear given by the length of buoy lines used. The dashed part of the line assumes a 200 foot sag in the line below the deepest buoy lines. The albacore could have been caught at any depth within this estimated range (or at shallower levels if caught during hauling or setting). In this Figure most of the catches are seen to occur at the base of the surface mixed layer and upper levels of the thermocline. Subsurface temperature in the vicinity of the longline gear ranged from 54°F to 66°F.

ACOUSTIC TRACKING

Two albacore were tagged with ultrasonic depth telemetering transmitters and tracked from the Sea World during the cruise. The first fish had a fork length of 80 cm and estimated weight of 22 pounds. The fish was caught by trolling on the Sea World and was tracked for about 14 hours beginning at 0810 on February 4. The second fish was 85 cm in fork length and weighed an estimated 26-1/2 pounds. It was caught by longline on the Taasinge and tagged while the Sea World stood by. After it was released personnel aboard the Sea World tracked the fish for about 24-1/2 hours beginning at 1755 on February 6.

The first fish, no. 82-1, traveled a total of 36.1 miles in an easterly direction and ended up 17.8 miles due east of its release position (see Figure 13). The second fish, no. 82-2, exhibited a more complicated swimming pattern moving rapidly southeast during the first two hours after release and then doubling back numerous times on its course. It covered 41 miles during the 24-1/2 hour track, but ended up only 8.6 miles southeast of the release position (see Figures 13 and 14).

Both fish exhibited similar day-night behavior during tracking. During daylight hours the fish swam near the bottom of the mixed layer in 480-500 feet of water making vertical excursions of only about 50 ft. At or near

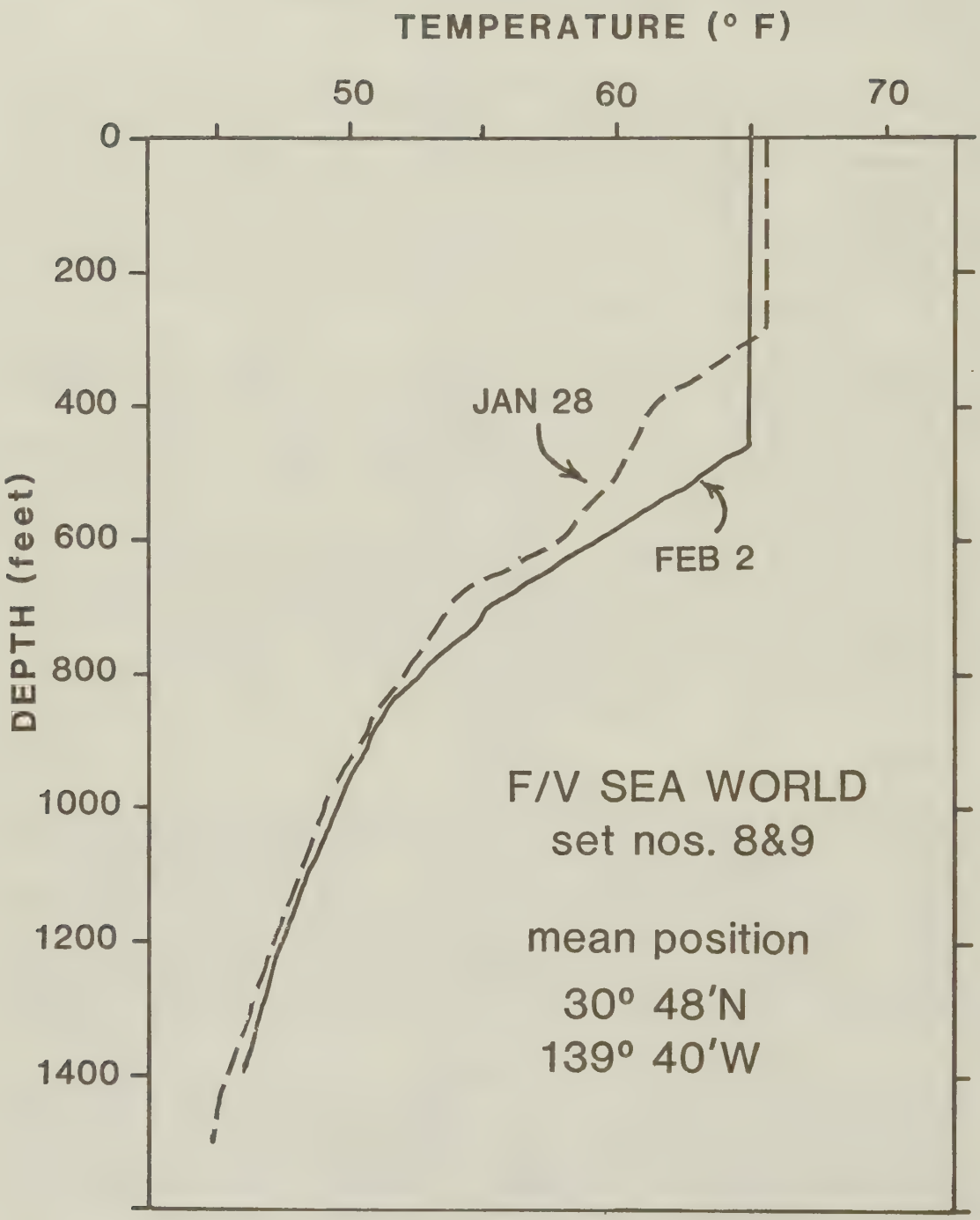

Figure 11. Two XBT traces taken at almost the same position just before and after a three day storm. The slight cooling of the upper mixed layer and deepening of the thermocline is apparent.

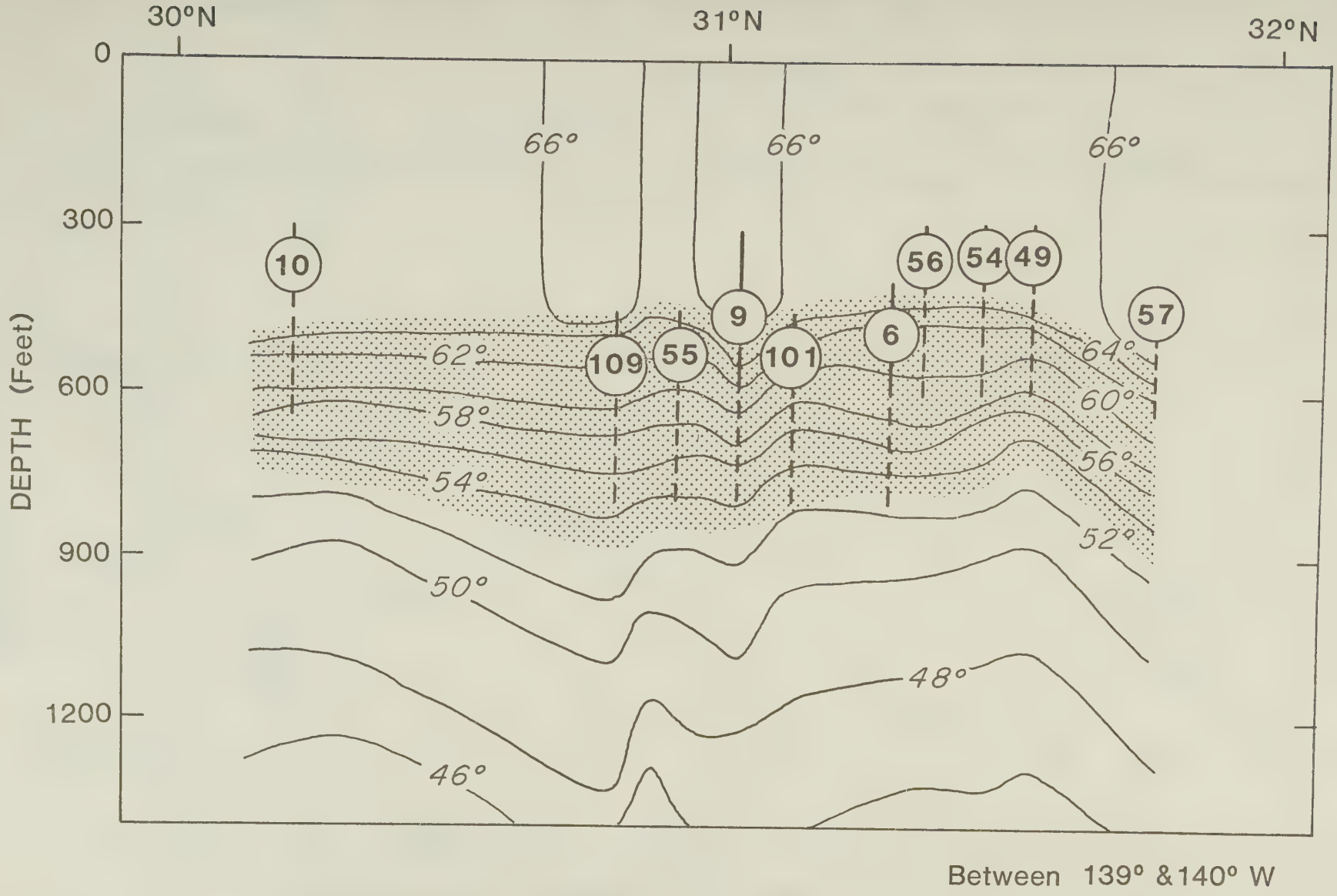

Figure 12. Example longline catches of the Taasinge and Arrow plotted on an isotherm section. The number of fish caught is inside each circle with buoy line lengths depicted by the solid vertical line. The dotted vertical line indicates potential fishing depths assuming a line sag of 200 feet below buoy line depth. The shaded area indicates the sharpest thermal gradient of the thermocline.

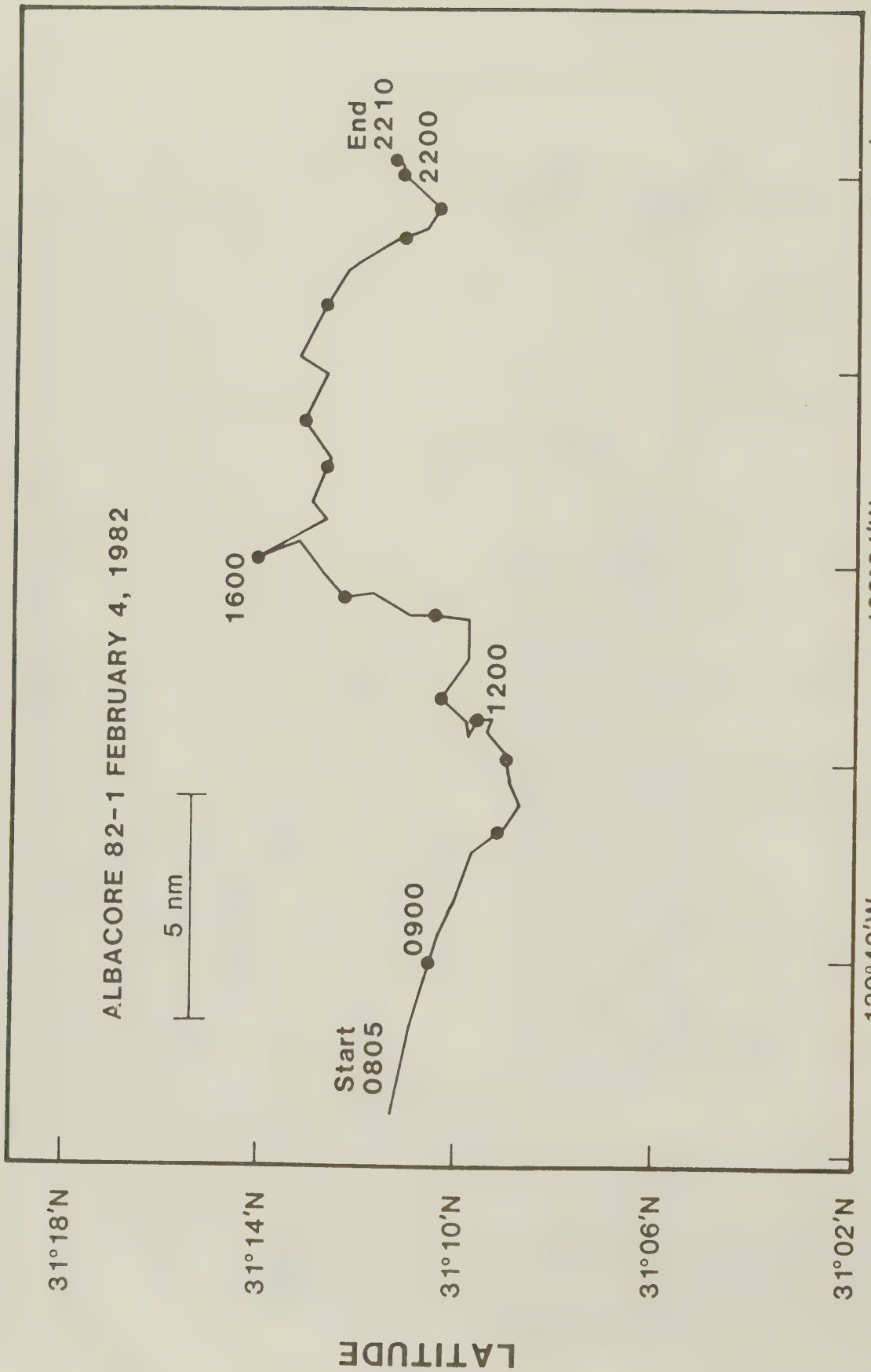

Figure 13. Track of acoustically-tagged albacore No. 82-1 (troll caught). Solid circles indicate hours of the clock.

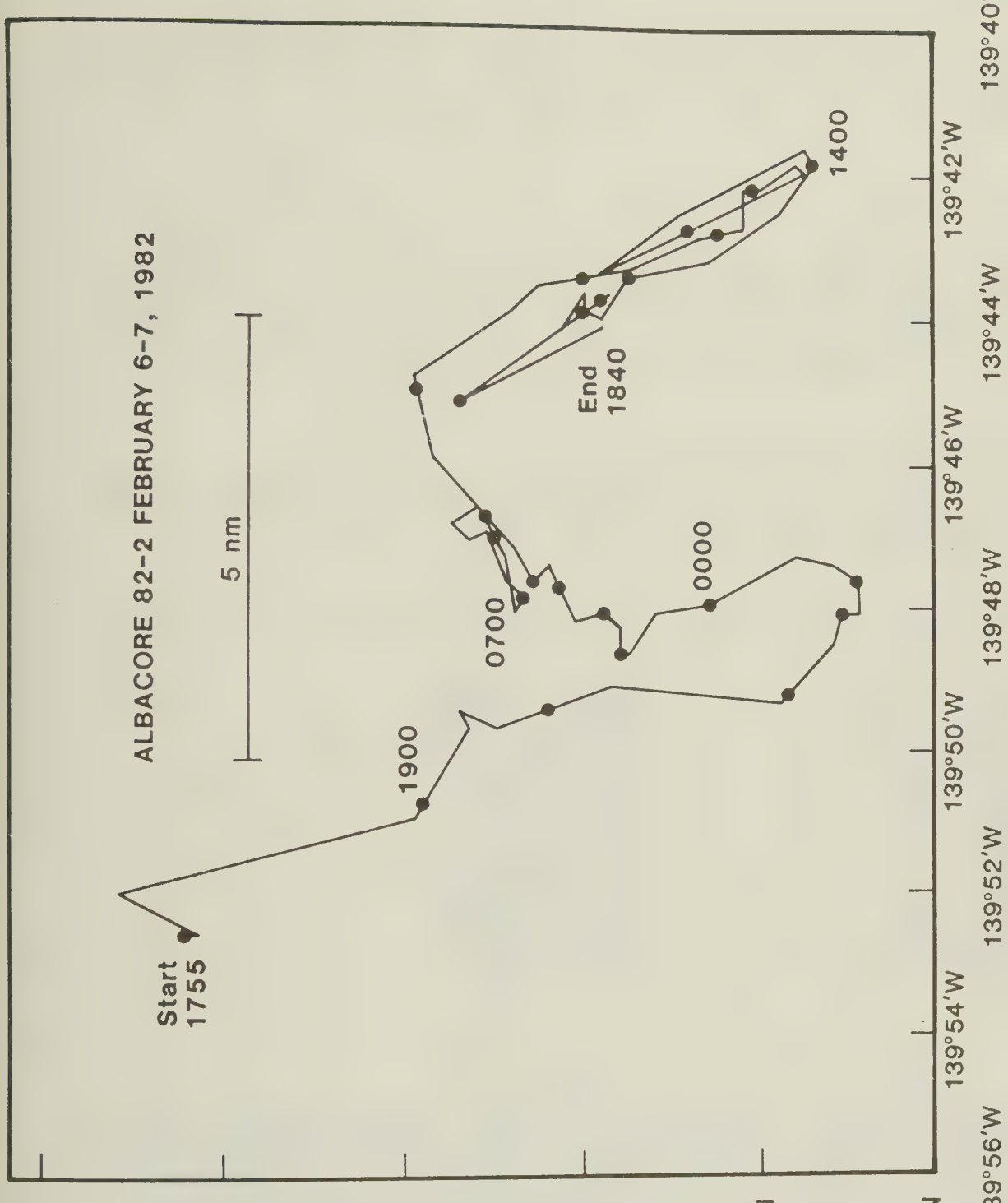

Figure 14. Track of acoustically-tagged albacore no. 82-2 (longline caught). Solid circles indicate hours of the clock.

sunset the fish rose in the water to a depth of about 350 feet and made frequent vertical excursions of about 100 feet. At sunrise the fish returned to deeper water and decreased the amplitude of vertical movements (see Figures 15 and 16).

ALBACORE TAGGING

Only 13 fish were tagged and released during the study--10 from the Taasinge, 2 from the Pacific Pioneer, and 1 from the Arrow. The fish tagged by the Taasinge ranged from 14 to 26 pounds and the fish from the other vessels were between 9 and 11 pounds. Fish caught by longline were usually unsuitable for tagging because they were dead or often appeared near death.

INCIDENTAL FISH CAUGHT BY LONGLINE

In addition to albacore and bigeye tuna, there were 12 species of fish caught by longline. The species and number caught are summarized in Table V below. Also, see Appendix 1.

Table V. Fish Other Than Albacore and Bigeye Tuna Caught by Longline

Longnose lancetfish	*Alepisaurus ferox*	122
Pelagic sting ray	*Dasyatis violacea*	36
Mahi-mahi	*Coryphaena hippurus*	33
Bigscale pomfret	*Taractichthys steindockneri* (?)	27
Blue shark	*Prionace glauca*	21
Jack crevalle	*Caranx hippos*	3
Swordfish	*Xiphias gladius*	2
Wahoo	*Acanthocybium solandri*	1
Opah	*Lampris regius*	1
Pilot fish	*Naucrates ductor*	1
Mako shark	*Isurus oxyrinchus*	1
Thresher shark	*Alopias* spp.	1

WEATHER

Weather had more of an impact upon fishing operations during this survey than during the survey of the prior year. In transit from Hawaii to the survey region the Pacific Pioneer encountered 25 to 30 knot winds from the east with 15-foot swell for five days which hampered fishing operations. While in the survey area all boats lost three consecutive days to fishing, except for one vessel, because of 30 to 50 knot winds and 10 to 20 foot sea/swell. During the remaining days weather was moderate, often having 5 to 10 knot winds in the morning increasing to 15 to 20 knots in the afternoon. There were occasional squalls. Swell ranged from 4 to 10 feet.

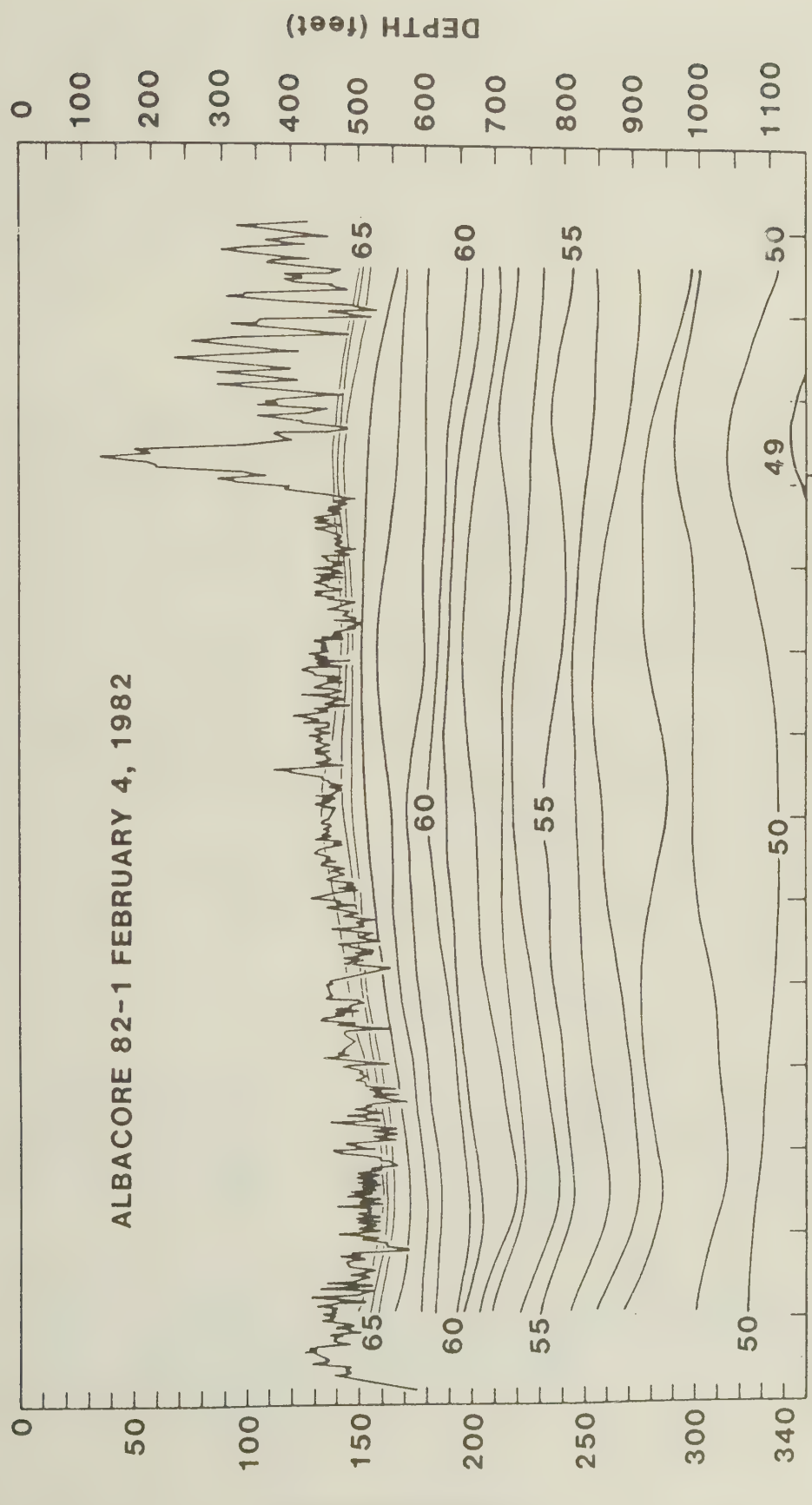

Figure 15. Plot of swimming depth of acoustically-tagged albacore no. 82-1 versus time with associated isotherms from XBT casts taken during the track.

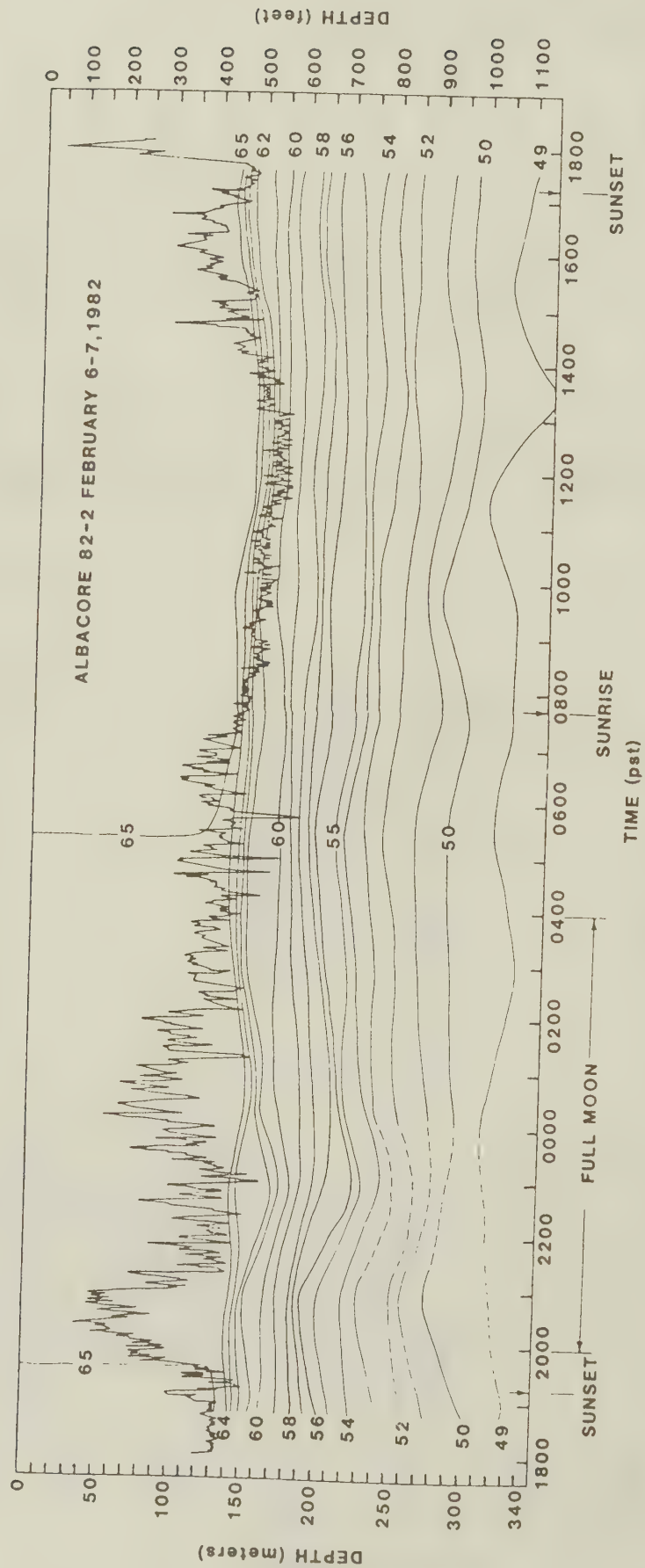

Figure 16. Plot of swimming depth of acoustically-tagged albacore no. 82-2 versus time with associated isotherms from XBT casts taken during the track. Sunrise and sunset times are marked at visually observed light levels.

FUEL CONSUMPTION

A very important finding resulting from the project is that the longline fishing operations are considerably more economical in daily fuel usage than are jig fishing methods used in the normal U.S albacore fishery. Daily fuel consumption in longlining is only 50 to 60 percent of the daily fuel consumption in jig fishing. Also the transit distance to and from the general longline fishing area is about the same or somewhat less than that which jigboats travel along the coast during the traditional U.S. fishery. For example a boat off southern California must travel 1200 miles when fishing is centered off central Oregon and about 1800 miles when fishing is off Vancouver Island, B.C.

CONCLUSIONS

This study shows that the U.S. albacore fishery can be extended to operate during winter months using longline fishing operations in an area where the fleet has not traditionally fished. It is anticipated that with gear modifications and careful selection and handling of bait that the overall catch rate of 3.2 albacore per 100 hooks, which was the average catch rate of the six vessels in this study, can be significantly increased. Based on the experiences gained from this project, modification to systems and operations should allow a vessel to fish 1500 to 2000 hooks per set. Because fuel consumption is much less than for standard trolling operations, more time can be spent on the longline grounds than is usual for a trolling trip.

More exploratory work is needed to examine the effect of seamounts and undersea ridges on fishing success. Also more knowledge is needed on the distribution of catches over the fall and winter seasons and their association with the seasonally changing oceanographic conditions. Experiments with artificial longline lures may also prove beneficial. Lastly, and importantly, an economic analysis is needed to explore the cost factors and potential expected benefits of longline operations. Such a study would provide a basis for choosing between longline operations or some alternate use of an albacore vessel.

RECOMMENDATIONS

The recommendations arising from the studies conducted in 1981 and 1982 fall into two categories: 1) those that are believed to be necessary for successful longline fishing operations for albacore during winter months, and 2) those that are believed be important, but require further experience or experimentation to validate.

Those in the first category include:

1. Use Omega or satellite navigation system. LORAN coverage is unsatisfactory in the offshore region. Accurate positioning is particularly important when releasing the first and last floats of a set in order to avoid losing time in relocating them or in losing the gear.

2. Bait hooks as gear is set.

3. Use only fresh bait of proper size in very good condition.

4. Use a crew of 3 or 4 depending upon operational requirements of vessel.

5. Use expendable bathythermograph (XBT) or other instrumentation for measuring vertical temperature profiles.

6. Use techniques to avoid loss of fish due to twisting of gangion and main line including: splicing swivels in gangion, adjusting snaps to fit loosely on main line in combination with stops or swivels in main line and maintaining minimum tension on main line during retrieval.

7. Use powered puller for retrieving buoy line.

8. Provide effective means for locating gear by use of a combination of equipment such as radio transmitters/RDF system, radar reflectors, Xenon or similar lights, flags placed at every 5 to 8 buoys.

9. Bring rubber gloves for use when baiting with squid.

10. Bring several long handled gaffs.

11. Ensure adequate floatation for supporting buoy lines by using 14 inch diameter, or larger, buoys.

12. Begin haul from first end set to equalize soak time.

13. Begin sets after first light to reduce bait loss, presumably to squid.

14. Use heavy duty longline reel to withstand the strain of hauling line.

Those in the second category include:

1. Use chromascope for locating fish.

2. Use five-foot gangions constructed with 200 to 250 pound test monofilament.

3. Allow no greater than 1800-foot baskets to control sag in main line. Also, buoy action may increase catch.

4. Some fishermen feel that circle hooks are more effective for catching tuna than other types of hooks.

5. Opinions vary on the size and strength of hook. Larger, stronger hooks may hold large albacore and bigeye tuna; whereas, smaller, lighter hooks may allow sharks to break away and thus minimize damage to gear.

6. Install throttle and steerage controls on working deck.

ACKNOWLEDGEMENTS

The successful completion of a project of this magnitude requires helpful input from many people. We express our appreciation to Dave Holts and Dimitry Abramenkoff for joining us as scientific observers aboard the vessels and for their excellent job. We also thank the staff of the Western Fishboat Owner's Association and the board of the American Fishermen's Research Foundation whose interest and cooperation in scientific inquiry into albacore research were fundamental to this project. We also thank Paul Fiedler for assisting in data analysis, Julie Shoemaker for the typing, especially for tricky tables that fill the appendices and Howard Ness and his staff at the Southwest Regional Office for their assistance in administering the grant.

Special thanks goes to the Captains (Herman, Palmer, Dave, Greg, Jim and Dixie) and crews of the six fishing vessels whose devotion to their profession and rugged individualism provided the backbone of this operation.

APPENDIX 1

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	No Set In Transit	No Set In Transit	1	No Set In Transit	No Set In Transit	No Set In Transit
Time and Start Set Position:	Pos. at 0900	Pos. at 0900	0730 28°32'N 156°35'W	Pos. at 0900	Pos. at 0700	Pos. at 0745
End Set	31°50'N 127°50°W	32°29'N 128°42°W	0840 28°32'N 156°39'W	32°05'N 127°40'W	31°48'N 125°44'W	32°41'N 129°42'W
Course of Set			270°			
Time and Start Haul Position:			1300 28°32'N 156°40'W			
End Haul			1800 28°32'N 156°36'W			
First Float Hauled:			Last Float Set			
Total No. Hooks			480			
Type of Hook			#36 JLL; #8 M. Circle			
Bait			Squid, Saury 1:1			
No. of Baskets			12			
Buoy Line Lengths			200, 400 ft.			
Mixed Layer Depth			330 ft.			
Wind: Speed Direction	12-15 kts. 000°	10 kts. 060°	20 kts. 110°	15-18 kts. 320°	12 kts. 320°	8 kts. 020°
Sea/Swell: Height Direction	8 ft. 305°	3 ft. 060°	8 ft. 110°	4 ft. 320°	6 ft. 320°	6 ft. 010°
Catch: Albacore			4			
Alb. Catch Rate (per 100 Hooks)			0.80			
Catch: Bigeye			2			
Catch: Sharks			1 Blue Shark			
Catch: Other			0			
Lost/Broken Hooks			NR			
Twisted Gangion			NR			
Alb. Lost at Surface			NR			

JLL = Japanese Longline M. Circle = Mustad Circle J. Circle = Japanese Circle NR = No Record

January 18

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	1	No Set In Transit	No Set Rough Weather	No Set In Transit	1	No Set In Transit
Time and Start Set	0800				0730	
Position:	31°47'N 129°14'W	Pos. at 0700 32° 07'N 130°06'W	Pos. at 0900 30°10'N 156°20'W	Pos. at 0730 32°03'N 130°43'W	31°51'N 129°11'W	Pos. at 0825 32°51'N 132°46'W
End Set	0915 31'46'N 129°11'W				0800 31°50'N 129°08'W	
Course of Set	090°				090°	
Time and Start Haul	1130				1145	
Position:						
End Haul	1400				1500	
First Float Hauled:	Last Float Set				First Float Set	
Total No. Hooks	288				282	
Type of Hook	#7, 8 M. Circle				#30 J. Circle	
Bait	Squid				Squid	
No. of Baskets	8				9	
Buoy Line Lengths	300, 450 ft.				50,75,300,450 ft.	
Mixed Layer Depth					220 ft.	
Wind: Speed	20 kts.	15 kts.	30 kts.	18-20 kts.	20 kts.	15 kts.
Direction	350°	020°	090°	314°	020°	340°
Sea/Swell: Height	7 ft.	3 ft.	12-20 ft.	5-8 ft.	8 ft.	8 ft.
Direction	350°	020°	090°	310°	000°	320°
Catch: Albacore	1				1	
Alb. Catch Rate (per 100 Hooks)	0.35				0.35	
Catch: Bigeye	0				0	
Catch: Sharks	0				0	
Catch: Other	0				0	
Lost/Broken Hooks	NR				1	
Twisted Gangion	NR				0	
Alb. Lost at Surface	NR				1	

JLL = Japanese Longline M. Circle = Mustad Circle J. Circle = Japanese Circle NR = No Record

January 19

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	No Set In Transit	No Set In Transit	No Set Rough Weather	No Set In Transit	No Set In Transit	1
Time and Start Set Position:	Pos. at 1200	Pos. at 1200	Pos. at 0808	Pos. at 0830	Pos. at 0900	0900 32°05'N 135°33'W
End Set	31°56'N 132°02'W	32°04'W 132°43'W	30°40'N 155°30'W	32°02'N 133°43'W	31°47'N 132°00'W	1033 32°01'N 135°32'W
Course of Set						180°
Time and Start Haul Position:						1245
End Haul						1825
First Float Hauled:						Last Float Set
Total No. Hooks						531
Type of Hook						#7, 8 M. Circle
Bait						Squid
No. of Baskets						17
Buoy Line Lengths						300, 450 ft.
Mixed Layer Depth						360 ft.
Wind: Speed Direction	15-20 kts. 270°	10 kts. 320°	25 kts. 090°	15 kts. 310°	20 kts. 270°	8 kts. 340°
Sea/Swell: Height Direction	10-18 ft. 290°	4-5 ft. 320°	12-20 ft. 090°	6 ft. 310°	12 ft. 290°	4 ft. 330°
Catch: Albacore						3
Alb. Catch Rate (per 100 Hooks)						0.56
Catch: Bigeye						0
Catch: Sharks						1 Blue Shark
Catch: Other						1 Stingray 2 Mahi Mahi
Lost/Broken Hooks						4
Twisted Gangion						0
Alb. Lost at Surface						0

JLL = Japanese Longline M. Circle = Mustad Circle J. Circle = Japanese Circle NR = No Record

January 20

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	2	No Set In Transit	No Set Rough Weather	1	2	No Set In Transit
Time and Start Set Position:	1000 31°49'N 134°25'W	Pos. at 0800 31°35'N 135°16'W	Pos. at 0800 32°15'N 153°40'W	0800 31°07'N 136°11W	1000 31°52'N 134°34'W	1000 31°45'N 137°03'W
End Set	1130 31°48'N 134°35'N			0930 30°58'N 136°04'W	1115 31°52'N 134°45'W	
Course of Set	270°			138°	270°	
Time and Start Haul Position:				1320 30°55'N 136°02'W	1400	
End Haul				2030 31°00'N 136°08'W	1930	
First Float Hauled:	First Float Set			Last Float Set	First Float Set	
Total No. Hooks	540			627	475	
Type of Hook	#7,8 M. Circle			#28 & 30 JLL	#30 J. Circle	
Bait	Squid			Squid & Pacific Mackerel	Squid	
No. of Baskets	15			22	20	
Buoy Line Lengths	300, 450 ft.			300 & 420 ft.	300, 450 ft.	
Mixed Layer Depth				340 ft.	340 to 280 ft.	
Wind: Speed Direction	20 kts. 290°	10-15 kts. 330°	25 kts. 090°	10-15 kts. 300°	20 kts. 300°	10 kts. 300°
Sea/Swell: Height Direction	12 ft. 310°	5 ft. 330°	12-20 ft. 090°	8 ft. 300°	12 ft. 315°	7 ft. 330°
Catch: Albacore	6			15	4	
Alb. Catch Rate (per 100 Hooks)	1.11			2.39	0.84	
Catch: Bigeye	0			0	0	
Catch: Sharks	0			1 Blue Shark	1 Blue Shark	
Catch: Other	3 Alepisaurus 1 Stingray			None	1 Alepisaurus 1 Stingray	
Lost/Broken Hooks	NR			5	6	
Twisted Gangion	NR			1	4	
Alb. Lost at Surface	NR			3 (1 to shark)	1	

JLL = Japanese Longline M. Circle = Mustad Circle J. Circle = Japanese Circle NR = No Record

January 21

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	3	1	No Set Rough Weather	2	3	2
Time and Start Set Position:	0815 31°49'N 136°25'W	0830 30°45'N 137°55'W	Pos. at 0800 32°05'N 151°35'W	1040 30°41.6'N 136°26.5'W	0800 31°56'N 136°25'W	0847 30°32'N 137°02'W
End Set	0935 31°48'N 136°22'W	1200 30°50'N 138°05'W		1138 30°36.2'N 136°28.1'W	0930 31°56'N 136°17'W	1005 30°26'N 137°05'W
Course of Set	090°	310°		145°	90°	220°
Time and Start Haul Position:	1300	1430		1410 30°35.0'N 136°28.0'W	1300	1155
End Haul	1830	2300		1710 30°41.7'N 136°28.4'W	1745	1550
First Float Hauled:	Last Float Set	First Float Set		Last Float Set	Last Float Set	Last Float Set
Total No. Hooks	720	≈1400		382	594	490
Type of Hook	#7, 8 M. Circle	#7 M. Circle		#28, 30 JLL	#30 J. Circle	#7, 8 M. Circle
Bait	Squid	Squid		Squid	Squid	Squid
No. of Baskets	20	34		12	26	18
Buoy Line Lengths	300, 450 ft.	450, 600 ft.		300, 420 ft.	300, 400 ft.	300, 450 ft.
Mixed Layer Depth		400 ft.		350 ft.	300 ft.	340 ft.
Wind: Speed Direction	10-15 kts. 360°	10 kts. 010°	30 kts. 090°	15 kts. 300°	12 kts. 310°	10 kts. 040°
Sea/Swell: Height Direction	10 ft. 320°	4 ft. 010°	12-18 ft. 090°	8-12 ft. 320°	8 ft. 310°	6 ft. 360°
Catch: Albacore	27	67		4	16	10
Alb. Catch Rate (per 100 Hooks)	3.75	≈4.79		1.05	2.69	2.04
Catch: Bigeye	0	3		1	0	0
Catch: Sharks	0	0		1 Blue Shark	0	0
Catch: Other	0	1 Large Scale Pomfret		0	1 Alepisaurus	1 Alepisaurus
Lost/Broken Hooks	NR	NR		0	1	2
Twisted Gangion	NR	NR		0	2	3
Alb. Lost at Surface	1	NR		0	2	0

JLL = Japanese Longline M. Circle = Mustad Circle J. Circle = Japanese Circle NR = No Record

January 22

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	4	2	No Set Rough Weather	3	4	No Set Trolling to New Area
Time and Position: Start Set	0810 32°00'N 138°05'W	0800 31°00'N 137°45'W		0810 30°44.3'N 138°12.8'W	0800 32°02'N 137°43'W	
End Set	0945 31°58'N 138°11'W	1100	Pos. at 1000 31°30'N 149°20'W	0925 30°43.5'N 138°22.4'W	0930 32°02'N 137°55'W	0745 30°13'N 138°06'W
Course of Set	270°	045°		260°	270°	
Time and Position: Start Haul	1300	1300		1230 30°41.3'N 138°22.6'W	1230	
End Haul	1830	2200		1830 30°41.6'N 138'16.9'W	1820	
First Float Hauled:	Last Float Set	First Float Set		Last Float Set	Last Float Set	
Total No. Hooks	975	≈1400		791	793	
Type of Hook	#7, 8 M. Circle	#7 M. Circle		#28, 30 JLL	#30 J. Circle	
Bait	Squid	Squid		Squid & Mackerel	Squid	
No. of Baskets	20	35		25	30	
Buoy Line Lengths	300, 450 ft.	450, 600 ft.		300, 420, 600 ft.	300, 400, 450 ft.	
Mixed Layer Depth		440 ft.		360 ft.	400 ft.	
Wind: Speed	10 kts.	10 kts.	25-30 kts.	15-20 kts.	8kts.	10 kts.
Direction	110°	060°	090°	300°	070°	060°
Sea/Swell: Height	6 ft.	4 ft.	12-20 ft.	8-10 ft.	5	4 ft.
Direction	310°	060°	090°	300°	045°	090°
Catch: Albacore	15	55		15	12	
Alb. Catch Rate (per 100 Hooks)	1.54	≈3.93		1.90	1.51	
Catch: Bigeye	0	1		0	1	
Catch: Sharks	0	0		2 Blue Sharks	0	
Catch: Other	0	1 Stingray		1 Stingray 3 Alepisaurus	1 Alepisaurus 1 Stingray	
Lost/Broken Hooks	7	NR		2	5	
Twisted Gangion	NR	NR		1	3	
Alb. Lost at Surface	NR	NR		3	1	

JLL = Japanese Longline M. Circle = Mustad Circle J. Circle = Japanese Circle NR = No Record

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	5	3	2	4	5	3
Time and Start Set Position: End Set	0800 31°32'N 138°02'W	0800 30°45'N 138°10'W	0700 31°25'N 148°36'W 0900 31°28'W 148°41'W	0810 30°46.0'N 139°40.1'W 1017 30°54.9'N 139°42.4'W	0800 31°29'N 138°05'W 0950 31°34'N 138°00'W	1657 31°26'N 140°53'W 1725 31°28'N 140°54'W
Course of Set	NR	335°	310°	320°	045°	335°
Time and Start Haul Position: End Haul			1600 31°29'N 148°41'W 2000 31°27'N 148°37'W	1305 30°53.2'N 139°42.5'W 2139 30°42.4'N 139°37.9'W	1205 2038	1915 2112
First Float Hauled:	Last Float Set	First Float Set	Last Float Set	Last Float Set	First Float Set	Last Float Set
Total No. Hooks	800	≈1400	800	1059	1164	229
Type of Hook	#7, 8 M. Circle	#8 M. Circle	#36 JLL, #8 M. Circle	#28 JLL	#30 J. Circle	#7, 8 M. Circle
Bait	Squid	Squid	Squid, Saury 1:1	Squid & Mackerel	Squid	Squid
No. of Baskets	22	17 (3600 ft.)	16	35	33	8
Buoy Line Lengths	300, 450 ft.	600 ft.	200, 400 ft.	300, 420, 600 ft.	400, 525, 600 ft.	75 ft.
Mixed Layer Depth			270 ft.	320 ft.	440 ft.	450 ft.
Wind: Speed Direction	10-15 kts. 160°	10-15 kts. 135°	15 kts. 180°	25 kts. 130°	18 kts. 140°	15 kts. 130°
Sea/Swell: Height Direction	6 ft. 160°	3 ft. 135°	12 ft. 180°	6 ft. 300°	6 ft. 180°	8 ft. 150°
Catch: Albacore	49	33	7	45	44	0
Alb. Catch Rate (per 100 Hooks)	6.12	≈2.36	0.88	4.25	3.78	0
Catch: Bigeye	0	0	3	0	3	0
Catch: Sharks	1 Blue Shark	0	0	0	0	0
Catch: Other	0	1 Largescale Pomfret 1 Mahi Mahi	3 Alepisaurus 3 Jack Crevalle	2 Mahi Mahi 1 Alepisaurus 2 Stingrays	2 Rays 1 Alepisaurus	1 Largescale Pomfret
Lost/Broken Hooks	NR	NR	NR	2	5	0
Twisted Gangion	NR	NR	NR	0	14	0
Alb. Lost at Surface	NR	NR	NR	2 (2 fish also shark bit)	4	0

JLL = Japanese Longline M. Circle = Mustad Circle J. Circle = Japanese Circle NR = No Record

January 24

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	6	4	3	5	6	No Set Trolling
Time and Start Set	0800	1430	0530	0715	0755	
Position: Start Set	30°43'N 140°20'W	31°05'N 138°20'W	31°39'N 147°17'W	30°51.8'N 139°40.5'W	31°02'N 140°02'W	Pos. at 1000
End Set	0940	1630	0730	1010	0935	31°10'N 140°37'W
	30°22'N 140°22'W		31°36'N 147°08'W	30°37.3'N 139°32.7W	31°02'N 139°48'W	
Course of Set	180°		110°	230°	090°	
Time and Start Haul	1115	1830	1500	1230	1225	
Position: Start Haul			31°38'N 147°10'W	30°46.3'N 139°36.8'W		
End Haul	1830	2300	2100	2000	2130	
			31°39'N 147°15'W	30°38.1'N 139°32.3'W		
First Float Hauled:	Last Float Set	First Float Set	Last Float Set	First Float Set	First Float Set	
Total No. Hooks	874	≈900	800	1020	1044	
Type of Hook	#7, 8 M. Circle	#8 M. Circle	#36 JLL #8 M. Circle	#28 & 30 JLL	#30 J. Circle	
Bait	Squid	Squid	Squid, Saury 1:1	Squid & Mackerel	Squid	
No. of Baskets	23	9 (3600 ft.)	16	33	31	
Buoy Line Lengths	450, 600 ft.	450 ft.	400 ft.	300, 420, 600 ft.	400, 525, 600 ft.	
Mixed Layer Depth		500 ft.(?)	370 ft.	350 ft.	360 ft.	
Wind: Speed	10-15 kts.	10-15 kts.	15-20 kts.	20 kts.	20 kts.	20 kts.
Direction	170°	135°	300°	140°	155°	180°
Sea/Swell: Height	10 ft.	3 ft.	8 ft.	6 ft.	6 ft.	10 ft.
Direction	160°	135°	300°	330°	155°	190°
Catch: Albacore	31	21	16	29	78	
Alb. Catch Rate (per 100 Hooks)	3.55	≈2.33	2.00	2.84	7.72	
Catch: Bigeye	0	0	2	2	0	
Catch: Sharks	0	0	0	0	0	
Catch: Other	1 Mahi Mahi	1 Alepisaurus	3 Alepisaurus	1 Alepisaurus 1 Stingray	None	
Lost/Broken Hooks	11	NR	NR	1	10	
Twisted Gangion	NR	NR	NR	1	15	
Alb. Lost at Surface	NR	NR	NR	2	3	

JLL = Japanese Longline M. Circle = Mustad Circle J. Circle = Japanese Circle NR = No Record

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	7	5	4	Line in Wheel No Set	7	4
Time and Start Set	0840	0900	0700		0800	0810
Position:		30°50'N 139°00'W	31°07'N 146°14'W	Pos. at 1100	30°58'N 140°01'W	31°08'N 139°05'W
End Set	1000	1130	0900	30°48'N 139°25'W	1000	0925
	31°59'N 139°21'W		30°54'N 146°14'W		31°05'N 140°03'W	31°06'N 138°59'W
Course of Set		280°	180°		350°	135°
Time and Start Haul	NR	1400	1600		1300	1212
Position:			30°56'N 146'14'W			
End Haul	NR	2100	2300		1732	1550
			31°00'N 146°15'W			
First Float Hauled:	Last Float Set	First Float Set	Last Float Set		First Float Set	Last Float Set
Total No. Hooks	800	≈1000	800		732	453
Type of Hook	#7,8 M. Circle	#8 M. Circle	#36 JLL, #8 M. Circle		#30 J. Circle	#7, 8 M. Circle
Bait	Squid	Squid	Squid		Squid	Squid
No. of Baskets	23	13 (3600 ft.)	16		20	8 (3600 ft.)
Buoy Line Lengths	300, 450, 600 ft.	450 ft.	400, 600 ft.		400, 600 ft.	600 ft.
Mixed Layer Depth		460 ft. (?)	390 ft.		320 ft.	420 ft.
Wind: Speed	25 kts.	20 kts.	30 kts.	35 kts.	25-30 kts.	18 kts.
Direction	310°	290°	310°	300°	320°	310°
Sea/Swell: Height	12 ft.	6 ft.	18 ft.	10 ft.	8 ft.	8 ft.
Direction	310°	290°	310°	310°	320°	300°
Catch: Albacore	11	43	1		20	1
Alb. Catch Rate (per 100 Hooks)	1.38	≈4.30	0.12		2.73	0.22
Catch: Bigeye	0	0	8		0	0
Catch: Sharks	0	0	0		0	0
Catch: Other	0	0	1 Stingray		1 Alepisaurus 1 Mahi Mahi	1 Stingray
Lost/Broken Hooks	NR	NR	Many		1	0
Twisted Gangion	NR	NR	NR		3	0
Alb. Lost at Surface	NR	NR	NR		2	0

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January 26

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	8	6	5	6	8	No Set Trolling
Time and Start Set	0800	0900	0700	0755	0730	
Position:	NR	30°50'N 139°15'W	31°06'N 145°09'W	30°56.5'N 139°42.4'W	30°43'N 140°45'W	0800
End Set	0945	1130	0900	1000	0930	31°37'N 138°49'W
	NR		30°55'N 145°06'W	30°45.5'N 139 49.9'W	30°49'N 141°00'W	
Course of Set		310°	170°	210°	290°	
Time and Start Haul	1200	1400	1400	1300	1130	
Position:				30°51.7'N 139°40.2'W		
End Haul	1845	2200	2000	2030	2130	
	31°11'N 140°16'W			30°40.3'N 139°50.2'W		
First Float Hauled:	Last Float Set	First Float Set	Last Float Set	First Float Set	First Float Set	
Total No. Hooks	996	≈1400	1000	886	1403	
Type of Hook	#7, 8 M. Circle	#8 M. Circle	#36 JLL, #8 M. Circle	#28 & 30 JLL	#30 J. Circle	
Bait	Squid	Squid	Squid & Saury	Squid & Mackerel	Squid	
No. of Baskets	25	20 (some 3600 ft.)	20	29	40	
Buoy Line Lengths	300, 450, 600 ft.	450 ft.	400, 600 ft.	420, 600 ft.	400, 450, 500, 525, 600 ft.	
Mixed Layer Depth		460 ft.	420 ft.	410 ft.	450 ft. (600?)	
Wind: Speed	5-10 kts.	10 kts.	5 kts.	10 kts.	5 kts.	15 kts.
Direction	0°	340°	310°	0°	315°	020°
Sea/Swell: Height	10 ft.	3 ft.	8 ft.	8 ft.	7 ft.	7 ft.
Direction	320°	340°	310°	330°	290°	350°
Catch: Albacore	15	109	6	48	28	
Alb. Catch Rate (per 100 Hooks)	1.51	≈7.79	0.60	5.42	2.00	
Catch: Bigeye	0	2	5	1	1	
Catch: Sharks	0	0	0	0	0	
Catch: Other	2 Mahi Mahi	0	1 Mahi Mahi 1 Wahoo	1Alepisaurus 1 Swordfish	4 Alepisaurus 1 Stingray	
Lost/Broken Hooks	NR	NR	A few	1	5	
Twisted Gangion	NR	NR	NR	1	5	
Alb. Lost at Surface	NR	NR	NR	3	0	

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	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	9	7	6	7	9	5
Time and Start Set Position: End Set	0745 31°55'N 139°00'W 0945 31°50'N 139°00'W	0830 30°45'N 139°30'W 1100	0700 32°03'N 144°16'W 0830 31°46'N 144°08'W	0750 30°36.9'N 139°51.9'W 1020 30°41.6'N 139°34.0'W	0930 30°52'N 139 58'W 0945 30°58'N 139°59'W	0804 32°40'N 138°39'W 1032 32°24'N 138°57'W
Course of Set	180°	305°	160°	060°	000°	180°
Time and Start Haul Position: End Haul	1200 NR	1400 2300	1300 1730	1250 30°35.2'N 139°46.3'W 2000 30°42.2'N 139°36.9'W	1215 2145	1205 1630
First Float Hauled:	Last Float Set	First Float Set	Last Float Set	First Float Set	First Float Set	Last Float Set
Total No. Hooks	1040-1300	≈1400	950	1046	1223	1080* (562 (hauled)
Type of Hook	#7, 8 M. Circle	#8 M. Circle	#36 JLL, #8 M. Circle	#28, 30 JLL	# 30 J.Circle	#7, 8 M. Circle
Bait	Squid	Squid	Squid & Saury	Squid & Mackerel 3:1	Squid	Squid
No. of Baskets	26	25 (some 3600 ft.)	19	32	33	18* set (9-1/2 hauled)
Buoy Line Lengths	150, 300, 450, 600 ft.	450, 600 ft.	400, 600 ft.	420, 600 ft.	450, 525, 600 ft.	600 ft.
Mixed Layer Depth		470 ft.	380 ft.	330 ft.	400 ft.	440 ft.
Wind: Speed Direction	5 kts. 340°	5-10 kts. 315°	5-10 kts. 310°	12 kts. 60°	5 kts. 045°	5 kts. 050°
Sea/Swell: Height Direction	10 ft. 340°	2 ft. 315°	8 ft. 310°	6 ft. 300°	6 ft. 315°	4 ft. 340°
Catch: Albacore	41	56	3	49	83	4
Alb. Catch Rate (per 100 Hooks)	≈3.50	≈4.00	0.32	4.68	6.80	0.71*
Catch: Bigeye	0	0	2	2	3	3
Catch: Sharks	1 Blue Shark	1 Thresher Shark	0	0	1 Mako Shark	0
Catch: Other	0	0	0	1 Alepisaurus 1 Stingray	1 Alepisaurus	1 Stingray
Lost/Broken Hooks	NR	NR	NR	1	6	1
Twisted Gangion	NR	NR	NR	1	23	1
Alb. Lost at Surface	NR	NR	NR	0	1	2

JLL = Japanese Longline M. Circle = Mustad Circle J. Circle = Japanese Circle NR = No Record *Lost Half of Gear

January 28

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	10	8	7	8	10	No Set Searching for Lost Gear
Time and Start Set	0800	0820	0730	0820	0745	
Position:	30°57'N 139°09'W	31°00'N 139°25'W	30°45'N 142°48'W	30°42.9'N 139°38.4'W	30°49'N 139°26'W	Pos. at 0910
End Set	1000	1100	0850	1050	0945	32°50'N 138°15'W
			30°38'N 142°54'W	30°50.9'N 139°27.7'W (Near Arrow Gear)	30°56'N 139°25'W (Near Korean Gear)	
Course of Set	NR	350°	225°	045°	045°	
Time and Start Haul	NR	1300	1300	1330	1140	
Position:				30°42.8'N 139°36.4'W		
End Haul	NR	2130	1730	2030	2108	
				30°51.4' 139°32.0'W		
First Float Hauled:	Last Float Set	First Float Set	Last Float Set	First Float Set	First Float Set	
Total No. Hooks	1100	≈1200	950	951	1381	
Type of Hook	#7, 8 M. Circle	#8 M. Circle	#36 JLL, #8 M. Circle	#28, 30 JLL	#30 J. Circle	
Bait	Squid	Squid	Squid	Squid & Mackerel 3:1	Squid	
No. of Baskets	21	24* (some dbl)	19	27 (9 tangled Korean)	34	
Buoy Line Lengths	150, 300, 450, 600 ft.	450, 600 ft.	400, 600 ft.	420, 600 ft.	450, 525, 600 ft.	
Mixed Layer Depth			330 ft.	320 ft.	440 ft.	
Wind: Speed	10-15 kts.	15 kts.	10-15 kts.	15 kts.	16-18 kts.	12 kts.
Direction	045°	020°	050°	030°	045°	045°
Sea/Swell: Height	10 ft.	6 ft.	8 ft.	6-8 ft.	7 ft.	7 ft.
Direction	000°	000°	050°	000°	000°	050°
Catch: Albacore	39	57	10	15	55	
Alb. Catch Rate (per 100 Hooks)	3.55	≈4.75	1.05	1.58	3.99	
Catch: Bigeye	0	3	3	1	4	
Catch: Sharks	0	0	0	0	0	
Catch: Other	0	1 Alepisaurus	6 Alepisaurus 1 Opah 2 Largescale Pomfret	2 Largescale Pomfret	1 Largescale Pomfret 1 Pelagic Stingray 1 Alepisaurus	
Lost/Broken Hooks	8	NR	NR	2	3	
Twisted Gangion	NR	NR	NR	0	18	
Alb. Lost at Surface	NR	NR	NR	1	2	

JLL = Japanese Longline M. Circle = Mustad Circle J. Circle = Japanese Circle NR = No Record *Some 3600 ft. baskets

January 29

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	11	9	8	Sonic Track Project Standing by F/V Taasinge	11	6
Time and Start Set	0800	0800	0700		0730	0854
Position:	30°52'N 139°17'W	30°58'N 139°36'W	30°52'N 141°29'W		30°54'N 139°00'W	33°01'N 138°14'W
End Set	0930	1100	0830		0930	1027
	30°53'N 139°09'W		30°45'N 141°35'W		30°54'N 139°12'W	32°58'N 138°32'W
Course of Set	090°	055°	225°		270°	270°
Time and Start Haul	1300	1300	1300	1100	1130	1200
Position:				31°03'N 139°34'W		
End Haul	1915	2230	1730		1900	1745
First Float Hauled:	First Float Set	First Float Set	Last Float Set		First Float Set	Last Float Set
Total No. Hooks	≈800	≈1400	950		≈1000	627
Type of Hook	#7, 8 M. Circle	#8 M. Circle	#36 JLL, #8 M. Circle		#30 J. Circle	#7, 8 M. Circle
Bait	Squid	Squid	Squid & Saury		Squid	Squid
No. of Baskets	22	29 (3 @ 3600 ft.)	19		28	11 (3600 ft.)
Buoy Line Lengths	150, 300, 450, 600 ft.	450, 600 ft.	400, 600 ft.		450, 600 ft.	600 ft.
Mixed Layer Depth		420 ft.	450 ft.		450 ft.	450 ft.
Wind: Speed	15-20 kts.	15 kts.	15-20 kts.	20 kts.	15 kts.	15 kts.
Direction	090°	020°	090°	060°	090°	090°
Sea/Swell: Height	10 ft.	5 ft.	6 ft.	8 ft.	8-10 ft.	7 ft.
Direction	090°	Confused	090°	300°	090°	090°
Catch: Albacore	23	101	26		32	3
Alb. Catch Rate (per 100 Hooks)	≈2.88	≈7.21	2.74		≈3.20	0.48
Catch: Bigeye	0	0	2		0	0
Catch: Sharks	1 Blue Shark		0		0	0
Catch: Other	0	3 Alepisaurus 1 Largescale Pomfret 1 Stingray	0		1 Alepisaurus 2 Largescale Pomfret	1 Mahi Mahi 1 Largescale Pomfret 2 Alepisaurus (lost)
Lost/Broken Hooks	NR	NR	NR		NR	2
Twisted Gangion	NR	NR	NR		NR	0
Alb. Lost at Surface	NR	NR	NR		1	0

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January 30

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	No Set Rough Weather	No Set Rough Weather	9	No Set Rough Weather	12	No Set Rough Weather
Time and Start Set Position:	Pos. at 1000 31°05'N 139°40'W	Pos. at 0900 31°04'N 139°36'W	0800 30°44'N 141°19'W	1600 31°17'N 139°29'W	0730 31°07'N 139°12'W	Pos. at 0910 ≈32°N 137°W
End Set			0930 30°52'N 141°24'W		0920 31°07'N 139°05'W	
Course of Set			020°		090°	
Time and Start Haul Position:			1330		1140	
End Haul			1800		1845	
First Float Hauled:			Last Float Set		Last Float Set	
Total No. Hooks			700		941	
Type of Hook			#36 JLL, #8 M. Circle		#30 J. Circle	
Bait			Squid		Squid	
No. of Baskets			14		28	
Buoy Line Lengths			400, 600 ft.		400, 450 ft.	
Mixed Layer Depth					500 ft.	
Wind: Speed Direction	35 kts. 110°	35-40 kts. 090°	25 kts. 110°	40 kts. 130°	30 kts. + 090° Rain	30-35 kts. 090°
Sea/Swell: Height Direction	9-12 ft. 110°	7 ft. 090°	10-12 ft. 110°	18 ft. 130°	10 ft. + 090°	15 ft. 130°
Catch: Albacore			10		21	
Alb. Catch Rate (per 100 Hooks)			1.43		2.23	
Catch: Bigeye			2		1	
Catch: Sharks			0		0	
Catch: Other			0		1 Alepisaurus 1 Largescale Pomfret	
Lost/Broken Hooks			Some broken Leaders		1	
Twisted Gangion			NR		4	
Alb. Lost at Surface			NR		0	

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January 31

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	No Set Rough Weather	No Set Rough Weather	No Set Rough Weather	No Set Rough Weather	13	No Set Rough Weather
Time and Start Set					0740	
Position:	Pos. at 1000	Pos. at 0900	Pos. at 1000	Pos. at 0930	31°18'N 139°36'W	Pos. at 1300
End Set	31°18'N 139°34'N	31°15'N 139°55'W	31°20'N 141°50'W	31°20'N 139°35'W	0930 31°15'N 139°45'W	30°02'N 140°25'W
Course of Set					315°	
Time and Start Haul					1100	
Position: End Haul					1750	
First Float Hauled:					Last Float Set	
Total No. Hooks					828	
Type of Hook					#30 J. Circle	
Bait					Squid	
No. of Baskets					25	
Buoy Line Lengths					400, 600 ft.	
Mixed Layer Depth					380	
Wind: Speed	35 + kts.	35-40 kts.	30 kts.	45 kts.	30-40 kts.	30 kts.
Direction	110°	090°	110°	130°	090°	120°
Sea/Swell: Height	12-20 ft.	8-10 ft.	12-20 ft.	20 ft.	15-18 ft.	15 ft.
Direction	110°	090°	110°	130°	090°	090°
Catch: Albacore					6	
Alb. Catch Rate (per 100 Hooks)					0.72	
Catch: Bigeye					0	
Catch: Sharks					0	
Catch: Other					0	
Lost/Broken Hooks					2	
Twisted Gangion					1	
Alb. Lost at Surface					0	

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February 1

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	No Set Rough Weather	No Set Rough Weather	No Set Rough Weather	No Set Rough Weather	14	No Set Rough Weather
Time and Start Set					0745	
Position:	Pos. at 1200	Pos. at 0900	Pos. at 1000	Pos. at 1250	30°52'N 139°13'W	Pos. at 0945
End Set	30°51'N 139°09'W	30°58'N 139°43'W	31°40'N 141°55'W	30°50'N 139°09'W	0930 30°50'N 139°20'W	30°09'N 139°04'W
Course of Set					270°	
Time and Start Haul					1130	
Position: End Haul					1630	
First Float Hauled:					Last Float Set	
Total No. Hooks					639	
Type of Hook					#30 J. Circle	
Bait					Squid	
No. of Baskets					19	
Buoy Line Lengths					400, 450, 600 ft.	
Mixed Layer Depth					460 ft.	
Wind: Speed	35 kts.	35-40 kts.	20-25 kts.	35 kts.	40-50 kts.	20-25 kts.
Direction	135°	090°	110°	130°	090°	090°
Sea/Swell: Height	12-20 ft.	10 ft.	12-18 ft.	15 ft.	20 ft.	10 ft.
Direction	135°	090°	110°	130°	090°	090°
Catch: Albacore					5	
Alb. Catch Rate (per 100 Hooks)					0.78	
Catch: Bigeye					1	
Catch: Sharks					0	
Catch: Other					1 Alepisaurus	
Lost/Broken Hooks					3	
Twisted Gangion					1	
Alb. Lost at Surface					0	

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February 2

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	12	10	10	9	15	7
Time and Position: Start Set	0800 30°54'N 139°42'W	0730 30°58'N 139°43'W	0800 30°45'N 140°40'W	0810 30°51.8'N 139°43.4'W	0730 30°56'N 139°35'W	0834 30°58'N 138°51'W
End Set	0930 30°50'N 139°35'W	1100	0930 30°44'N 140°46'W	1005 30°38.8'N 139°41.2'W	0910 30°54'N 139°41'W	1043 31°06'N 139°02'W
Course of Set	140°	110°	270°	170°	270°	335°
Time and Position: Start Haul	1200	1300	1400	1230 30°38.1'N 139°41.4'W	1140	1208
End Haul	1730	2200	1830	1830 30°52.4'N 139°46.6'W	1725	2127
First Float Hauled:	First Float Set	First Float Set	Last Float Set	Last Float Set	First Float Set	Last Float Set
Total No. Hooks	800	≈1200	900	884	924	997
Type of Hook	#7, 8 M. Circle	#8 M. Circle	#36 JLL, #8 M. Circle	#28 & 30 JLL	#30 J. Circle	#7, 8 M. Circle
Bait	Squid	Squid	Squid	Squid	Squid	Squid
No. of Baskets	18	30	18	26	23	17 (3600 ft.)
Buoy Line Lengths	150, 300, 450 ft.	450, 600 ft. (2)	400, 600 ft.	420, 600 ft.	300, 400, 600, 800 ft.	600 ft.
Mixed Layer Depth		510 ft.	480 ft.	460 ft.	500 ft.	390 ft.
Wind: Speed	25 kts.	25 kts.	15-20 kts.	20 kts.	18 kts.	18 kts.
Direction	130°	110°	110°	120°	130°	130°
Sea/Swell: Height	10-15 ft.	8 ft.	8 ft.	6 ft.	7 ft. +	8 ft.
Direction	130°	110°	110°	120°	130°	120°
Catch: Albacore	17	34	37	11	9	13
Alb. Catch Rate (per 100 Hooks)	2.12	≈2.83	4.11	1.24	0.97	1.30
Catch: Bigeye	1	2	1	0	0	2
Catch: Sharks	0	0	0	0	0	0
Catch: Other	0	1 Alepisaurus	1 Mahi Mahi 3 Alepisaurus 1 Stingray	None	0	1 Swordfish 2 Alepisaurus (Lost)
Lost/Broken Hooks	1	NR	NR	1	3	0
Twisted Gangion	NR	NR	NR	1	2	4
Alb. Lost at Surface	NR	NR	NR	1	1	0

JLL = Japanese Longline M. Circle = Mustad Circle J. Circle = Japanese Circle NR = No Record

February 3

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	13	11	11	10	16	8
Time and Position: Start Set	0800 31°02'N 140°00'W	0800 31°20'N 139°30'W	0800 30°40'N 140°43'W	0815 31°06.3'N 140°10.3'W	0710 30°58'N 140°02'W	0747 31°20'N 138°50'W
End Set	0930 31°08'N 140°05'W	1130	0930 30°40'N 140°47'W	0940 31°10.7'N 140°14.0'W	0930 30°56'N 139°55'W	0933 31°23'N 138°59'W
Course of Set	215°	120°	270°	300°	090°	270°
Time and Position: Start Haul	1200	1300	1230	1230 31.09.6'N 140°14.2'W	1320	1125
End Haul	1800	2200	1700	1800 31°06.8'N 140°10.4'W	2045	1810
First Float Hauled:	Last Float Set	First Float Set	Last Float Set	Last Float Set	First Float Set	Last Float Set
Total No. Hooks	≈900 +	≈1200	1000	570	1214	767
Type of Hook	#7, 8 M. Circle	#8 M. Circle	#36 JLL, #8 M. Circle	#28, 30 JLL	#30 J. Circle	#7, 8 M. Circle
Bait	Squid	Squid	Squid	Squid	Squid	Squid
No. of Baskets	22	29	20	16	27	13(3600 ft.)
Buoy Line Lengths	150, 300, 450 ft.	450 ft.	400, 600 ft.	420, 600 ft.	300, 400, 450 ft.	600 ft.
Mixed Layer Depth		440 ft.	520 ft.	520 ft.	420 ft.	
Wind: Speed Direction	30 kts. 110°	25-30 kts. 110°	25 kts. 110°	10 kts. 070°	20 kts + 140°	15 kts. 160°
Sea/Swell: Height Direction	12-15 ft. 110°	8 ft. 110°	10 ft. 110°	6 ft. 070°	7 ft. 140°	6 ft. 140°
Catch: Albacore	13	54	12	11	32	17
Alb. Catch Rate (per 100 Hooks)	≈1.44	≈4.50	1.20	1.93	2.64	2.22
Catch: Bigeye	2	3	0	2	0	0
Catch: Sharks	0	0	1 Blue Shark	0	0	0
Catch: Other	0	3 Alepisaurus 1 Mahi Mahi 1 Largescale Pomfret	4 Alepisaurus 2 Mahi Mahi	1 Stingray	2 Alepisaurus	1 Alepisaurus
Lost/Broken Hooks	2	NR	NR	0	0	0
Twisted Gangion	NR	NR	NR	1	4	3
Alb. Lost at Surface	NR	NR	NR	0	1	1

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February 4

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	14	12	12	Tracking	17	9
Time and Start Set	0800	0730	0730	82-1	0720	0806
Position:	30°57'N 140°05'W	31°30'N 140°00'W	30°49'N 141°04'W	1300	31°05'N 140°00'W	31°33'N 138°35'W
End Set	0945	1030	0900	31°14'N 139°30'W	0930	0955
			30°53'N 140°58'W		31°03'N 139°55'W	31°32'N 138°57'W
Course of Set		120°	045°		110°	335°
Time and Start Haul	1230	1300	1300		1320	1110
Position: End Haul		2200	1900		2045	1810
First Float Hauled:	Last Float Set	First Float Set	Last Float Set		First Float Set	Last Float Set
Total No. Hooks	≈900 +	≈1250	1000		1197	770
Type of Hook	#7, 8 M. Circle	#8. M. Circle	#36 JLL, #8 M. Circle		#30 J. Circle	#7, 8 M. Circle
Bait	Squid	Squid	Squid		Squid	Squid
No. of Baskets	25	32	20		29	13 (3600 ft.)
Buoy Line Lengths	150, 300, 450 ft.	450 ft.	400, 600 ft.		300, 400, 450, 600 ft.	600 ft.
Mixed Layer Depth			470 ft.		500 ft.	
Wind: Speed	2-5 kts.	10-15 kts.	5 kts.	10 kts.	12 kts.	15 kts.
Direction	180°	135°	170°	070°	155°	240°
Sea/Swell: Height	8 ft.	4-5 ft.	8 ft.	6 ft.	10 ft. +	6 ft.
Direction	135°	135°	170°	070°	135°	200°
Catch: Albacore	30	62	76	4 (trolling)	28	15
Alb. Catch Rate (per 100 Hooks)	≈3.33	≈4.96	7.60		2.34	1.95
Catch: Bigeye	6	1	10		7	2
Catch: Sharks	0	0	0		0	0
Catch: Other	0	1 Alepisaurus 1 Stingray 1 Largescale Pomfret	0		1 Alepisaurus 1 Albacore (trolling)	1 Alepisaurus 2 Mahi Mahi
Lost/Broken Hooks	NR	NR	NR		0	1
Twisted Gangion	NR	NR	NR		11	3
Alb. Lost at Surface	NR	NR	NR		2	1 (Shark ate)

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	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	15	13	13	11	18	10
Time and Start Set	0815	0745	0730	0830	0730	0803
Position:	31°20'N 140°02'W	31°30'N 140°00'W	31°09'N 141°13'W	31°14.5'N 139°35.1'W	31°14'N 139°50'W	31°26'N 138°41'W
End Set	0915	1130	0900	1020	1000	0945
	31°21'N 140°07'W		31°09'N 141°18'W	31 °09.5'N 139°21.4'W	31°15'N 139°43'W	31°20'N 139°10'W
Course of Set	270°	085°	270°	090°	090°	270°
Time and Start Haul	1300	1300	1230	1215	1215	1151
Position:				31°09.4'N 139°29.9'W		
End Haul	1645	2300	1730	1735	1930	2107
				31°10.3'N 139°23.5'W		
First Float Hauled:	Last Float Set	First Float Set	Last Float Set	First Float Set	First Float Set	Last Float Set
Total No. Hooks	625+	≈1400	1000	673	1253	1007
Type of Hook	#7, 8 M. Circle	#8 M. Circle	#36 JLL, #8 M. Circle	#28 & 30 JLL	#30 J. Circle	#7, 8 M. Circle
Bait	Squid	Squid	Squid & Saury	Squid	Squid	Squid
No. of Baskets	13	30	20	20	29	13 (3600 ft.)
Buoy Line Lengths	300, 450 ft.	450 ft.	400, 600 ft.	420, 600 ft.	300, 400, 450 ft.	450, 600 ft.
Mixed Layer Depth			450 ft.	450 ft.	440 ft.	
Wind: Speed	30 kts.	25-30 kts.	15 kts.	30-35 kts.	25 kts. +	18 kts.
Direction	090°	070°	090°	090°	090°	060°
Sea/Swell: Height	10-15 ft.	8-10 ft.	6-8 ft.	6-10 ft.	7 ft.	8 ft.
Direction	090°	070°	090°	090°	090°	090°
Catch: Albacore	27	67	48	15	56	31
Alb. Catch Rate (per 100 Hooks)	≈4.32	≈4.79	4.80	2.23	4.47	3.08
Catch: Bigeye	0	1	4	0	1	0
Catch: Sharks	0	1 Blue Shark	0	0	0	0
Catch: Other	0	2 Alepisaurus 2 Largescale Pomfret	1 Mahi Mahi	1 Stingray 1 Alepisaurus	1 Stingray 3 Alepisaurus	1 Largescale Pomfret 1 Alepisaurus (lost)
Lost/Broken Hooks	NR	NR	NR	0	3	4
Twisted Gangion	NR	NR	NR	0	8	5
Alb. Lost at Surface	NR	NR	NR	0	2	2

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February 6

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	16	14	14	Tracking	19	11
Time and Start Set	0800	0730	0900		0720	0749
Position:	31°18'N 139°58'W	31°30'N 140°00'W	31°03'N 140°55'W	Pos. at 1300	31°18'N 140°05'W	31°20'N 139°02'W
End Set	0930	1100	1030		1000	0937
	31°20'N 140°04'W		31°03'N 141°02'W	31°22.3'N 139°54.1'W	31°23'N 139°44'W	31°21'N 139°08'W
Course of Set	290°	090°	270°		050°	225°
Time and Start Haul		1300			1200	1118
Position: End Haul		2200			2240	1937
First Float Hauled:	Last Float Set	First Float Set	Last Float Set		First Float Set	Last Float Set
Total No. Hooks	≈1000	≈1000	1000		≈1500	1,009
Type of Hook	#7, 8 M. Circle	#8 M. Circle	#36 JLL, #8 M. Circle		#30 J. Circle	#7, 8 M. Circle
Bait	Squid	Squid	Squid		Squid	Squid
No. of Baskets	25	26	20		37	13 (3600 ft.)
Buoy Line Lengths	300, 450 ft.	450 ft.	400, 600 ft.		300, 400, 450 ft.	450, 600 ft.
Mixed Layer Depth			470 ft.		420 ft.	
Wind: Speed	10-15 kts.	10-15 kts.	25 kts.	18-20 kts.	18 kts.	15 kts.
Direction	090°	090°	070°	090°	090°	070°
Sea/Swell: Height	8-10 ft.	4-5 ft.	10 ft.	6 ft.	6 ft.	5 ft.
Direction	090°	090°	070°	060°	090°	080°
Catch: Albacore	136	57	28		59	17
Alb. Catch Rate (per 100 Hooks)	≈13.6	≈ 5.70	2.80		≈3.93	1.68
Catch: Bigeye	0	3	4		1	1
Catch: Sharks	0	0	0		0	0
Catch: Other	1 Pilot Fish	1 Stingray 4 Alepisaurus	2 Stingrays		2 Alepisaurus 1 Mahi Mahi	1 Mahi Mahi 1 Largescale Pomfret 1 Alepisaurus (lost)
Lost/Broken Hooks	NR	NR	NR		NR	3
Twisted Gangion	NR	NR	NR		NR	3
Alb. Lost at Surface	NR	NR	NR		NR	0

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February 7

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	17	15	15	Tracking	20	12
Time and Position: Start Set	0800 31°15'N 139°52'W	0800 31°40'N 139°55'W	0800 31°24'N 140°53'W	Pos. at 0900 31°15'N 139°40'W	0740 31°13'N 140°13'W	0755 31°17'N 139°26'W
End Set	0925 31°14'N 140°01'W	1130	0930 31°19'N 140°59'W		0950 31°15'N 140°20'W	0950 31°13'N 139°46'W
Course of Set	270°	070°	220°		280°	270°
Time and Position: Start Haul	1145	1300	1230		1200	1140
End Haul		2200	1700		2053	1836
First Float Hauled:	Last Float Set	First Float Set	Last Float Set		Last Float Set	Last Float Set
Total No. Hooks	≈1000	≈1300	1000		1684	989
Type of Hook	#7, 8 M. Circle	#8 M. Circle	#36 JLL, #8 M. Circle		#30 J. Circle	#7, 8 M. Circle
Bait	Squid	Squid	Squid		Squid	Squid
No. of Baskets	25	30	20		39	13(3600 ft.)
Buoy Line Lengths	300, 450 ft.	450 ft.	400, 600 ft.		75, 300, 400, 450 ft.	450, 600 ft.
Mixed Layer Depth		520 ft.	470 ft.		460 ft.	540 ft.
Wind: Speed	15-20 kts.	20-25 kts.	20 kts.	20 kts.	15-18 kts.	15 kts.
Direction	070°	070°	070°	090°	070°	110°
Sea/Swell: Height	10 ft.	8 ft.	8 ft.	10 ft.	5 ft.	5 ft.
Direction	090°	070°	070°	090°	070°	060°
Catch: Albacore	29	53	59		34	9
Alb. Catch Rate (per 100 Hooks)	≈2.90	≈4.08	5.90		2.02	0.91
Catch: Bigeye	1	2	2		2	1
Catch: Sharks	0	0	0		2 Blue Sharks	0
Catch: Other	0	2 Pelagic Stingrays	2 Alepisaurus 1 Stingray		4 Alepisaurus 1 Stingray	1 Mahi Mahi
Lost/Broken Hooks	NR	NR	NR		5	2
Twisted Gangion	NR	NR	Few		12	1
Alb. Lost at Surface	NR	NR	7		3	1

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February 8

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	18	16	16	12	21	13
Time and Start Set		0800	0700	0800	0745	0820
Position:	Pos. at 1000	31°20'N 140°30'W	31°32'N 140°42'W	31°19.6'N 139°57.1'W	31°15'N 140°15'W	31°36'N 139°32'W
End Set	31°08'N 140°18'W	1100	0840	0930	1000	1012
			31°31'N 140°46'W	31°17.6'N 140°07.0'W	31°05'N 140°22'W	
Course of Set	NR	075°	270°	250°	200°	270°
Time and Start Haul	NR	1300	1220	1245	1220	1148
Position:				31°14.6'N 140°04.5'W		
End Haul		2100	1800	1920	2020	1837
				31°16.2'N 139°55.2'W		
First Float Hauled:	NR	First Float Set	Last Float Set	Last Float Set	Last Float Set	Last Float Set
Total No. Hooks	≈800	≈1100	1050	769	≈1535	1,019
Type of Hook	#7, 8 M. Circle	#8 M. Circle	#36 JLL, #8 M. Circle	#28, #30 JLL	#30 J. Circle	#7, 8 M. Circle
Bait	Squid	Squid	Squid	Squid	Squid	Squid
No. of Baskets	20	29	21	29	36	13 (3600 ft.)
Buoy Line Lengths	300, 450 ft.	300 ft.	400, 600 ft.	300, 420 ft.	300, 400, 450 ft.	450, 600 ft.
Mixed Layer Depth		460 ft.	490 ft.		450 ft.	480 ft.
Wind: Speed	15 kts.	15-20 kts.	25 kts.	5-10 kts.	5 kts.	25 kts.
Direction	090°	070°	070°	090°	070°	090°
Sea/Swell: Height	10 ft.	6 ft.	5-6 ft.	5 ft.	8 ft.	7 ft.
Direction	090°	070°	070°	060°	070°	090°
Catch: Albacore	8	51	36	19	18	34
Alb. Catch Rate (per 100 Hooks)	≈1.00	≈4.64	3.43	2.47	≈2.02	3.34
Catch: Bigeye	0	3	0	0	2	6
Catch: Sharks	0	0	1 Blue	0	0	0
Catch: Other	0	5 Alepisaurus 1 Stingray	1 Largescale Pomfret	3 Alepisaurus	4 Alepisaurus	1 Alepisaurus
Lost/Broken Hooks	NR	NR	NR	0	NR	0
Twisted Gangion	NR	NR	NR	0	NR	2
Alb. Lost at Surface	NR	NR	NR	0	NR	1

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February 9

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	19	17	17	13	22	14
Time and Position: Start Set	0800 30°23'N 138°51'W	0730 31°25'N 140°23'W	0800 31°18'N 141°43'W	1915 30°08.8'N 137°42.1'W	0800 30°13'N 139°17'W	0802 31°29'N 140°10'W
End Set	0915 30°18'N 138°44'W	1030	0930 31°16'W 141°48'W	2030 30°15.0'N 137°37.9'W	0950 30°05'N 139°10'W	0952 31°33'N 140°17'W
Course of Set	135°	120°	250°	000°	140°	270°
Time and Position: Start Haul	1145	1300	1220	0330 30°14.2'N 137°39.8'W	1200	1150
End Haul		2200	1700	0700 30°09.1'N 137°40.7'W	1842	1828
First Float Hauled:	First Float Set	First Float Set	Last Float Set	Last Float Set	First Float Set	Last Float Set
Total No. Hooks	≈800	≈1350	1000	542	1478	1,041
Type of Hook	#7, 8 M. Circle	#8 M. Circle	#36 JLL, #8 M. Circle	#28,30 JLL, 12/0 Swof.	#30 J. Circle	#7, 8 M. Circle
Bait	Squid	Squid	Squid	Squid (sm hk) Mack (lg hk)	Squid	Squid
No. of Baskets	23	32	20	35 (900 ft.)	31	13 (3600 ft.)
Buoy Line Lengths	300, 450 ft.	450 ft.	300, 400, 600 ft.	30 ft.	300, 400, 450 ft.	450, 600 ft.
Mixed Layer Depth		490 ft.	360 ft.		480 ft.	440 ft.
Wind: Speed Direction	5 kts. 180°	10 kts. 110°	5 kts. 120°	5 kts. 150°	5 kts. 180°	25 kts. 090°
Sea/Swell: Height Direction	5 ft. 090°	3 ft. 110°	6 ft. 090°	3 ft. 150°	5 ft. 180°	7 ft. 090°
Catch: Albacore	5	79	26	0	10	18
Alb. Catch Rate (per 100 Hooks)	≈0.62	≈5.85	2.60	0	0.68	1.73
Catch: Bigeye	5	4	1	0	6	3
Catch: Sharks	0	1 Blue Shark	0	Bit Hk-parted line	2	0
Catch: Other	0	2 Alepisaurus	2 Mahi Mahi	4 Largescale Pomfret (1 was sharkbit)	4 Alepisaurus 1 Stingray	0
Lost/Broken Hooks	NR	NR	NR	1	NR	0
Twisted Gangion	NR	NR	NR	1	NR	0
Alb. Lost at Surface	NR	NR	NR	0	NR	1

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February 10

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	20	18	18	In Transit to San Diego	23	15
Time and Start Set	0800	0800	0730		0750	0757
Position:	31°33'N 139°37'W	31°10'N 140°35'W	31°36'N 142°02'W	Pos. at 0900	31°31'N 139°40'W	31°44'N 139°52'W
End Set	0930	1030	0900	30°14'N 137°05'W	1000	0940
	31°33'N 139°28'W		31°36'N 142°09'W		31°30'N 139°30'W	31°58'N 139°06'W
Course of Set	180°	290°	270°		090°	270°
Time and Start Haul	1200	1300	1230		1200	1153
Position:						
End Haul	1815	2230	1700		1915	1825
First Float Hauled:	Last Float Set	First Float Set	Last Float Set		First Float Set	First Float Set
Total No. Hooks	≈850	≈1250	1000		1459	1029
Type of Hook	#7, 8 M. Circle	#8 M. Circle	#36 JLL, #8 M. Circle		#30 J. Circle	#7, 8 M. Circle
Bait	Squid	Squid	Squid		Squid	Squid
No. of Baskets	30	32	20		31	13 (3600 ft.)
Buoy Line Lengths	300, 450 ft.	450 ft.	300, 400, 600 ft.		300, 400 ft.	450, 600 ft.
Mixed Layer Depth		520 ft.	410 ft.		430 ft.	520 ft.
Wind: Speed	05	5 kts.	10-15 kts.	5 kts.	5 kts.	5 kts.
Direction	090°	090°	090°	170°	090°	090°
Sea/Swell: Height	8-10 ft.	2 ft.	6 ft.	2 ft.	5 ft.	4 ft.
Direction	070°	090°	090°	170°	045°	060°
Catch: Albacore	64	99	21		46	23
Alb. Catch Rate (per 100 Hooks)	≈7.53	≈7.92	2.10		3.07	2.24
Catch: Bigeye	1	7	4		1	5
Catch: Sharks	1 Blue Shark	0	1 Blue Shark		2 Blue Sharks	0
Catch: Other	1 Mahi Mahi	5 Alepisaurus 1 Mahi Mahi 1 Stingray	4 Alepisaurus		7 Mahi Mahi 1 Stingray 4 Alepisaurus	1 Mahi Mahi 1 Mahi Mahi (Lost) 1 Alepisaurus (Lost)
Lost/Broken Hooks	NR	NR	NR		NR	0
Twisted Gangion	NR	NR	NR		NR	0
Alb. Lost at Surface	NR	NR	NR		NR	0

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February 11

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	No Set Running to San Diego	19	19	No Set Running to San Diego	No Set Running to San Diego	16
Time and Position: Start Set		0800 31°10'N 140°35'W	0700 31°19'N 140°59'W			0803 31°24'N 140°33'W
End Set	Pos. at 1030 31°55'N 137°36'W	1100	0830 31°21'N 140°49'W	Pos. at 0900 30°14'N 134°03'W	Pos. at 1030 31°35'N 137°35'W	0935 31°27'N 140°31'W
Course of Set		125°	080°			000°
Time and Position: Start Haul		1300	1200			1235
End Haul		2200	1730			1815
First Float Hauled:		First Float Set	Last Float Set			Last Float Set
Total No. Hooks		≈1250	950			924
Type of Hook		#8 M. Circle	#36 JLL, #8 M. Circle			#7, 8 M. Circle
Bait		Squid	Squid			Squid
No. of Baskets		32	19			12 (3600 ft.)
Buoy Line Lengths		450 ft.	400, 600 ft.			450 ft.
Mixed Layer Depth			470 ft.			
Wind: Speed	5 kts.	10-15 kts.	10-15 kts.	10 kts.	5 kts.	10 kts.
Direction	180°	180°	220°	130°	180°	230°
Sea/Swell: Height	4-6 ft.	0 ft.	6 ft.	4 ft.	5 ft.	5 ft.
Direction	090°		220°	150°	090°	210°
Catch: Albacore		38	53			13
Alb. Catch Rate (per 100 Hooks)		≈3.04	5.58			1.41
Catch: Bigeye		2	1			1
Catch: Sharks		0	0			1 Blue (Lost)
Catch: Other		4 Alepisaurus 1 Largescale Pomfret 2 Stingray	0			2 Alepisaurus (Lost)
Lost/Broken Hooks		NR	NR			2
Twisted Gangion		NR	NR			0
Alb. Lost at Surface		NR	NR			0

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February 12

	ALASKA	ARROW	PACIFIC PIONEER	SEA WORLD	TAASINGE	TEMPTATION
Set No.	No Set Running to San Diego	20	20	No Set Running to San Diego	No Set Running to San Diego	No Set Running to San Diego
Time and Start Set		0830	0730			
Position:	Pos. at 1200	31°40'N 140°00'W	31°14'N 140°54'W	Pos. at 0900	Pos. at 1000	Pos. at 0850
End Set	31°45'N 134°00'W	1100	0900 31°18'N 140°47'W	30°38'N 131°11'W	31°50'N 134°15'W	31°38'N 138°08'W
Course of Set		140°	070°			
Time and Start Haul		1300	1200			
Position: End Haul		1900	1730			
First Float Hauled:		First Float Set	Last Float Set			
Total No. Hooks		≈900	950			
Type of Hook		# 8 M. Circle	#36 JLL, #8 M. Circle			
Bait		Squid	Squid			
No. of Baskets		23	19			
Buoy Line Lengths		450 ft.	400, 600 ft.			
Mixed Layer Depth						
Wind: Speed	10-15 kts.	20-25 kts.	30-35 kts.	5 kts.	10-12 kts.	20 kts.
Direction	180°	160°	200°	160°	225°	170°
Sea/Swell: Height	5-8 ft.	6 ft.	10 ft.	2 ft.	5-8 ft.	8 ft.
Direction	180°	160°	200°	170°	180°	180°
Catch: Albacore		8	26			
Alb. Catch Rate (per 100 Hooks)		≈0.89	2.74			
Catch: Bigeye		1	4			
Catch: Sharks		0	0			
Catch: Other		0	1 Largescale Pomfret			
Lost/Broken Hooks		NR	NR			
Twisted Gangion		NR	NR			
Alb. Lost at Surface		NR	NR			

JLL = Japanese Longline M. Circle = Mustad Circle J. Circle = Japanese Circle NR = No Record